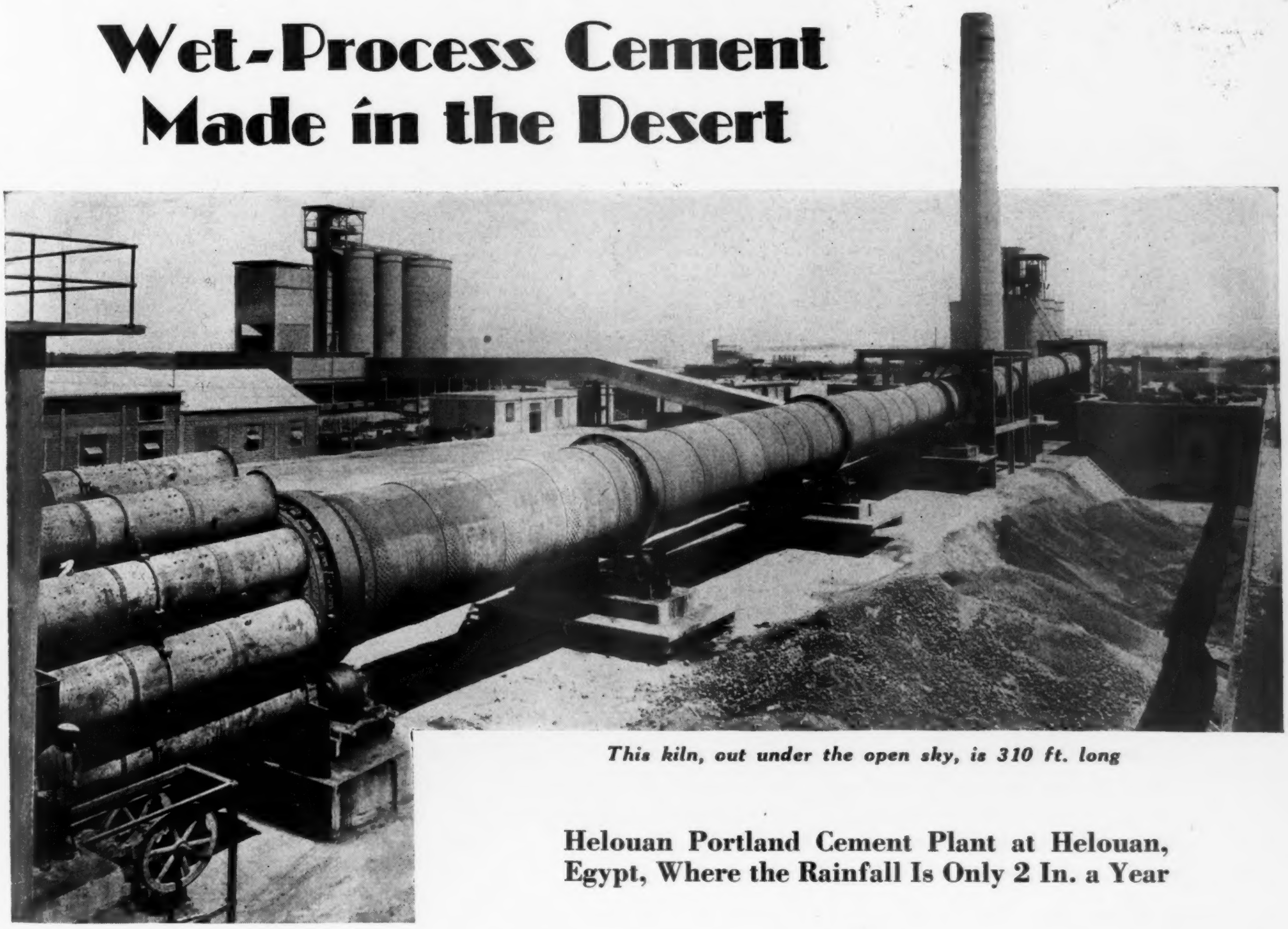
Rock Products

With which is Incorporated CEMENT and ENGINEERING NEWS

Founded 1896

Volume XXXIV | Chicago, August 29, 1931 | Number 18

Wet-Process Cement Made in the Desert



This kiln, out under the open sky, is 310 ft. long

Helouan Portland Cement Plant at Helouan, Egypt, Where the Rainfall Is Only 2 In. a Year

AN INTERESTING PLANT and one with an unusual setting is that of the Helouan Portland Cement Co. at Helouan (Helwan) on the river Nile, about 20 mi. south of Cairo, Egypt.

Helouan is one of the health resorts of Egypt and owes part of its fame to the dryness of its climate, having an annual rainfall of only about 2 in. and summer temperatures as high as 118 deg. in the shade.

Naturally the high temperatures and the dryness as well as other local conditions influenced to quite an extent the plant layout and the character of the buildings. Before starting the design a thorough study was made of these factors and resulted in a rather unique layout.

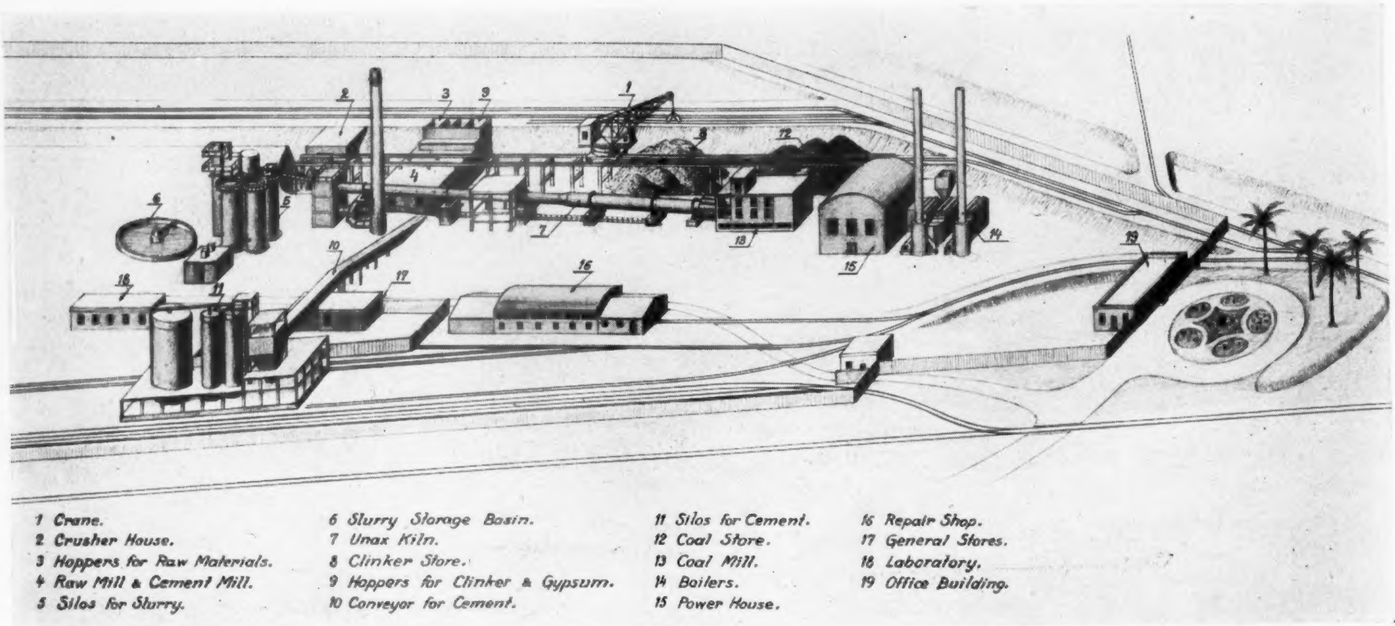
The plant is located on desert land consisting of a fairly hard sand with the ground water many feet below the surface so that this was a factor also in deciding upon the layout. Another point taken into account was the cheapness of Arab labor for such work as quarrying and excavating.

Limestone and clay are used as the raw materials. The limestone is a fairly soft stone quarried from the low hills near the plant, this work being done by contract and in a rather primitive way. It is transported to the plant in flat bottom cars which are unloaded by hand, as shown in an accompanying photograph. This method was decided on as being cheaper than a power dumper when interest and depreciation of the equipment is taken into consideration.

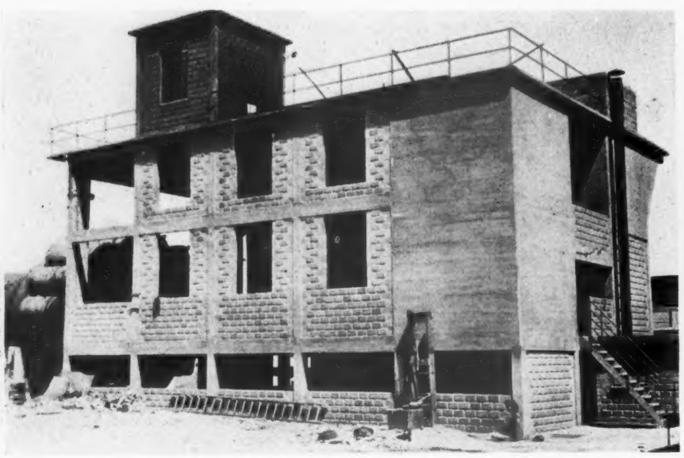
The clay is taken from the bank of the river Nile nearby and transported in the same way. Gypsum is found as a surface layer on the hills a few miles away and is brought to the plant on camel back, as shown in one of the pictures.

The plant was put in operation in May, 1930, and has a production capacity of 600,000 bbl. of portland cement per year with provisions for increasing the capacity by the addition of other units. It is owned by Egyptian, Danish and English capital.

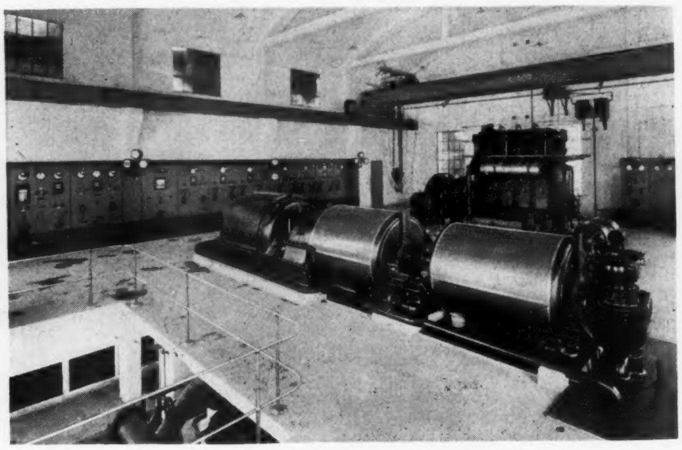
All of the engineering for the plant was done by F. L. Smidth and Co., who also supplied all of the cement-making machinery.



Layout of the plant, even to the trees and flower beds



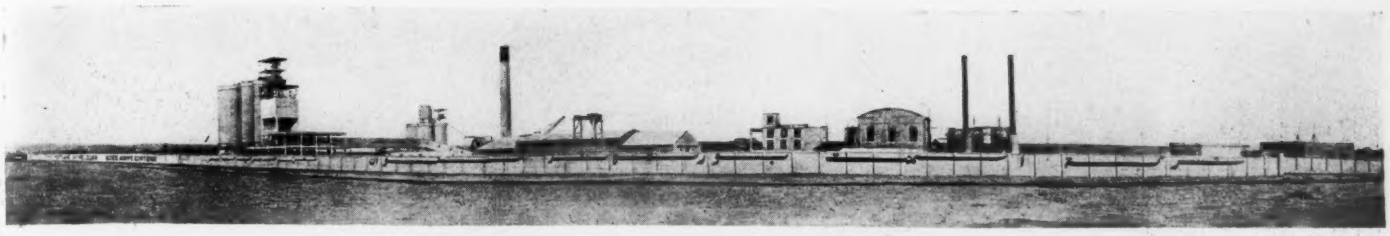
Coal mill building



Interior of power station

Underground crusher house, and electric crane for raw materials, clinker, gypsum and coal

Cement storage silos and packing house, with train to carry away the filled bags



General view of cement plant on the Nile River

The buildings are of reinforced concrete, open so far as possible to suit the climate and with solid roofs to protect the workmen from the hot sun. No buildings were needed over the storages and only a small roof over the driving mechanism of the kiln.

Raw Material Handling

The limestone is unloaded from the quarry cars to a hopper and is then carried on an apron conveyor to a large hammer mill. From this mill the pulverized limestone is taken by belt conveyor to a pocket in the raw storage yard from which it is handled by a crane to the feed hopper above the raw grinding mill.

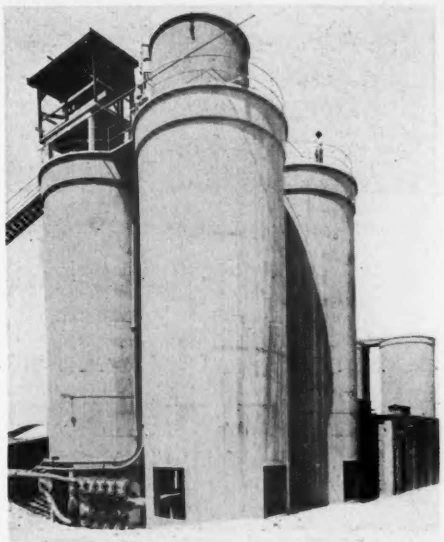
The clay is unloaded from the cars directly to the clay storage space and then handled in the same manner by the crane to the feed hopper above the raw mill.

These raw storage spaces extend along one side of the plant and are served by an electric crane with clamshell bucket, as indicated in several of the pictures.

A 7-ft. 4-in. by 40-ft. Unidan mill is used for the fine grinding of the raw materials, grinding about 850 cu. ft. of slurry per hr. to a fineness of 95% through 180 mesh. The slurry, containing 37% of water, is pumped up to one of four correction tanks, each of which has a capacity of 8,000 cu. ft. of slurry and from which it goes to a storage basin.

This is a flat bottom basin 66 ft. in diameter with a capacity of about 35,000 cu. ft. of slurry and equipped for both mechanical and air agitation.

From this basin the slurry is then elevated to the top of the correction silos and fed to the kiln by a rotary scoop type feeder, the speed of which is controlled from the burner's platform.



Slurry correction silos

Burning

One kiln 310 ft. long by 8-ft. 4-in. in diam. is used for burning the clinker. This has an enlarged burning zone of 10 ft. 4 in. diam. and is provided with a Unax cooler. The clinker falls directly to a pocket in the storage space, from which it is handled by the crane either to storage or to the feed hopper above the clinker grinding mill.

An exhaust fan discharges the waste gases from the kiln to a 132-ft. reinforced concrete chimney.

The burning is done with coal which comes from England or Russia and is transferred at Alexandria to lighters or native boats in which it is brought up the Nile to an unloading dock about 500 yd. from the plant.

Coal Grinding Plant

The boats are unloaded by hand, which is stated to be cheaper than a crane could do it, and the coal is taken on cars to a coal storage similar to those for the other raw materials.

From storage the coal is handled by the crane to the hopper over the coal grinding mill and also to the hopper at the boiler house.

An F. L. Smidth air-swept tube mill is used for grinding the coal. This dries and grinds the coal in one operation, reducing the moisture content from about 5% in the raw coal to 1% in the pulverized coal. It grinds about 100 lb. of coal per horsepower hour.

The fan which blows the coal dust and air into the kiln is connected with the cyclone above the coal mill so that the mill is under a slight vacuum and no dust escapes into the plant.

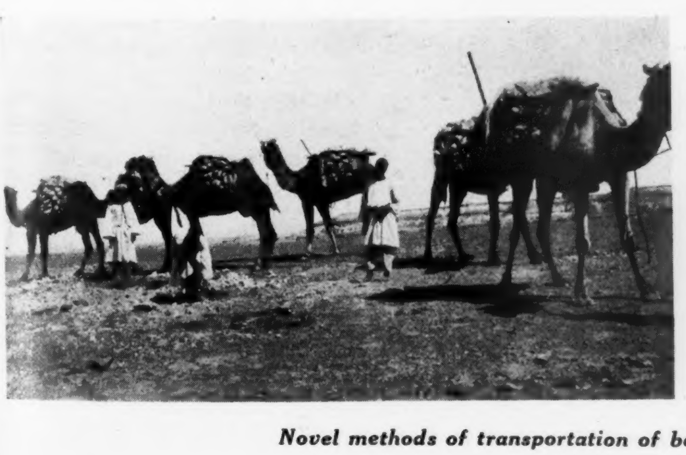
Clinker Grinding

An additional 7 ft. 4 in. by 40 ft. Unidan mill, located in the same building as the raw mill, is used for grinding the clinker. This is ground to a fineness of 95% through 180 mesh and at a rate of 18 tons of cement per hour.

The clinker and gypsum are handled to feed hoppers above the mill by the same crane used in handling the raw materials, the gypsum having been previously pulverized by putting it through the hammer mill in which stone is reduced.

From the mill the finished cement is

(*Continued on page 21*)



Novel methods of transportation of both raw material and finished product

Quarry at Stringtown, Okla., plant of Southwest Stone Co.

Crushed Stone Operations of the Southwest Stone Co.

Plants Are Located in Texas and Oklahoma

THE SOUTHWEST STONE CO., with general offices in Dallas, Texas, has four different crushed stone plants located at three rather widely separated points; namely, at Stringtown, Oklahoma, approximately 135 miles north of Dallas, one plant; at Chico and Bridgeport, Texas, about 80 miles northwest of Dallas, two plants; and at Knippa, Texas, about 80 miles west of San Antonio, one plant. The Chico and Bridgeport plants are only about 3½ miles apart, but Stringtown and Knippa are separated by a distance of about 500 miles.

The deposits at Chico and Bridgeport are approximately the same, a limestone of medium hardness, while the Stringtown deposit is a harder limestone and the Knippa deposit is an exceedingly hard trap rock of columnar formation. The materials are used for railroad ballast, and for road construction and concrete work.

The methods used are different at each plant, except as to Chico and Bridgeport, and each has some interesting features, such as hand picking of the stone on the upper ledge and electric shovel loading on the lower ledge at Chico, the use of both well drill holes and snake holes in quarrying at Stringtown, and the use of the tunnel method of blasting entirely at Knippa.

A blast at the Stringtown quarry

Stringtown, Okla., Plant

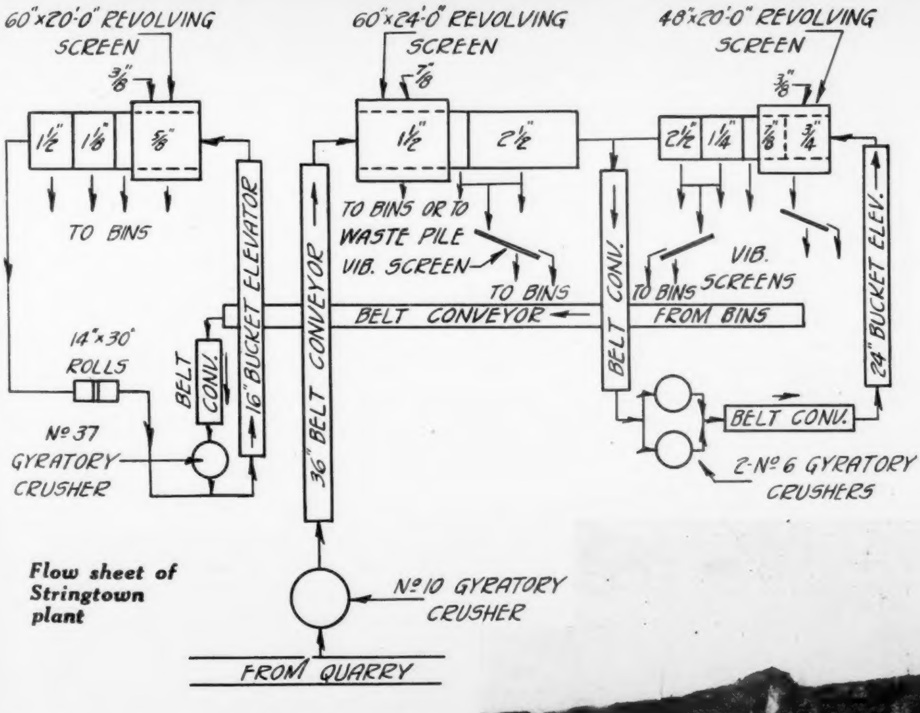
The Stringtown plant, located on the Missouri, Kansas and Texas railway, was built about 12 years ago and was taken over by the Southwest Stone Co. in 1929. It has a capacity of about 1500 tons per ten hour day and practically all shipments are by rail.

Quarrying is done in the side of a hill on a present face of 130 to 150 ft. with the quarry floor above the level of the crushing plant and loading tracks. The deposit is stratified, with the strata on edge at an angle of 70 deg. from the horizontal and sloping back away from the quarry floor.

Vertical blast holes are drilled down from the top by an Armstrong motor-driven drilling rig using a 5⅝-in. bit, but because of the slope of the face and the distance back to these holes at the bottom, a row of horizontal holes is also put in near the quarry floor by means of air drills. The well drill holes are spaced about 20 ft. apart and the air drill holes 4 to 5 ft. The latter are sprung and then both sets loaded and shot at one time.

The broken rock is loaded to 4-yd. Western type side dump cars by railroad type steam shovels, two model 70 and one model 75 Bucyrus shovels with 2½-yd. dippers being available for this work. Three trains of seven cars each are used for transporting

Looking toward Stringtown plant from top of storage pile. Primary crusher house at left center, screen house and loading bins at right



Flow sheet of Stringtown plant

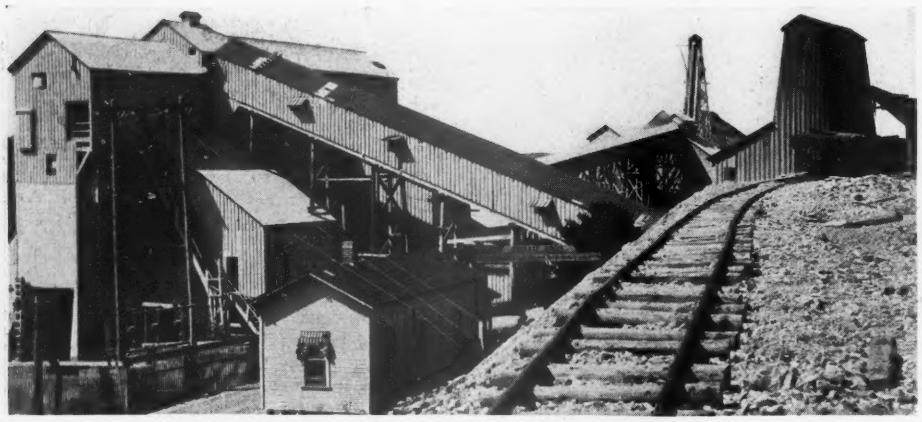
the rock to the crushing plant and are hauled by 18-ton Davenport locomotives on 36-in. gage track.

At the crushing plant the cars are dumped to a No. 10K Allis-Chalmers gyratory crusher, belt driven by a 100-hp. General Electric squirrel cage motor.

This primary crusher discharges to a 36-in. inclined belt conveyor which carries up to a 60-in. by 24-ft. Austin single-jacketed revolving screen above the bins. In this screen the 1½-in. and 2½-in. sizes are screened out to bins and the oversize returned on a belt to the recrushers. By means of a 4-ft. by 5-ft. single-deck Hummer vibrating screen below the revolving screen either of these sizes may be further cleaned before spouting to the bins. Also by means of a ⅞-in. jacket on the revolving screen any dirty or unfit material may be removed and carried by belt conveyors to a waste pile.

The main 36-in. belt and the revolving screen are both belt driven from a 50-hp.

Below—Steam shovel loading cars at Stringtown quarry



Stringtown plant seen from dumping track, with primary crusher at right and loading bins and screen house at left

General Electric slip ring motor. Two No. 6 Gates gyratory crushers are used for re-crushing and are driven through a lineshaft by a 100-hp. General Electric motor. The recrushed material is carried on a short belt conveyor and a 24-in. belt bucket elevator to a 48-in. by 20-ft. single-jacketed Austin revolving screen above the bins and in line with the first screen. This screen is equipped with ¾-, ⅞-, 1¼- and 2½-in. perforations and a ⅜-in. mesh jacket and the two larger sizes may be further cleaned over a second Hummer screen in the same way as below the first revolving screen. This revolving screen and elevator are belt driven by a 50-hp. General Electric motor.

The rejections from both screens are returned on a belt conveyor which discharges to a stone box above the recrushers. This box is mounted on wheels and a track so that it may be moved out of the way when it is necessary to make any repairs to the crushers.

From one side of the loading bins stone of any size may be drawn on to an 18-in. belt conveyor and fed to a No. 37 Kennedy gearless fine reduction crusher for further recrushing. This crusher is belt driven by a 40-hp. General Electric motor. From this point the recrushed material is carried up in a 16-in. belt bucket elevator to a third screen in line with the other two above the loading bins where additional smaller sizes are separated out to the bins. This screen is a 60-in. by 20-ft. Kennedy revolving screen and is driven by a 25-hp. General Electric motor. The oversize is spouted down to a set of 14- by 30-in. Buchanan rolls from which it is returned to the same elevator.

From the other side of the bins spouts are arranged so that various sizes may be taken on an 18-in. belt conveyor to a plant for making asphaltic road materials, or may be carried on by another belt to a storage pile.

A belt conveyor has also been installed so the various sizes may be drawn from the bins in any desired proportions for loading. This is for the purpose of combining them to reduce the percentage of voids and meet the newer specifications and it is stated that the voids can be reduced in this way to 34 or 35%.

The loading bins are of timber construction on concrete walls with 13 compartments and are about 110 ft. long. Some experimenting has been done in the way of blowing the dust out of the larger sizes as they are being loaded to the cars below the bins. It is understood that it has been possible in this way to reduce the amount of dust in the stone to 0.10%. The same method has been used at the Chico plant and consists in directing a current of air from a blower across the stream of stone as it falls through a spout to the car.

Chico Plant

At the Chico plant the upper part of the deposit contains some clay seams which have made it necessary to use considerable care in getting out the stone and have also required diverting part of the stone to a waste pile at times.

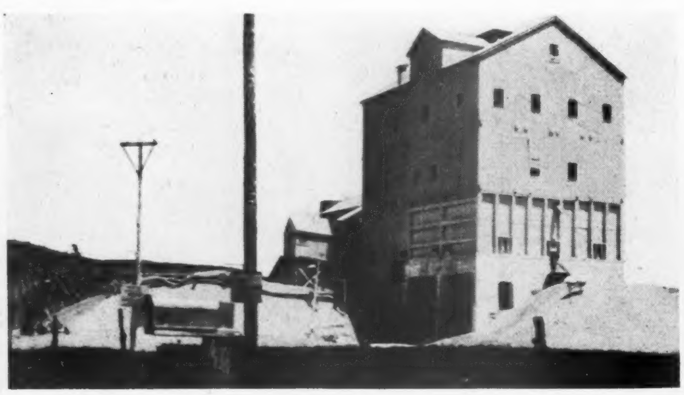
However, within the past few months a change has been made in the quarrying methods so that now the top 25 ft. is handled separately from the rest and another cut has been started which will be carried down 40 ft. below the top one. The clay seams do not extend below the 25-ft. ledge and the lower cut containing clean stone is being quarried separately.

This stone is loaded by a 1¾-yd. 50-B Bucyrus-Erie electric shovel to 6-yd. Western type side dump cars on a standard gage track. Three trains are used, two of 5 cars each with 20-ton Vulcan and Lima rod-type steam locomotives, and one of 9 cars with a heavier Lima Shay geared locomotive. A "60" Marion railroad type steam shovel and an Osgood traction type shovel are also available for the loading.

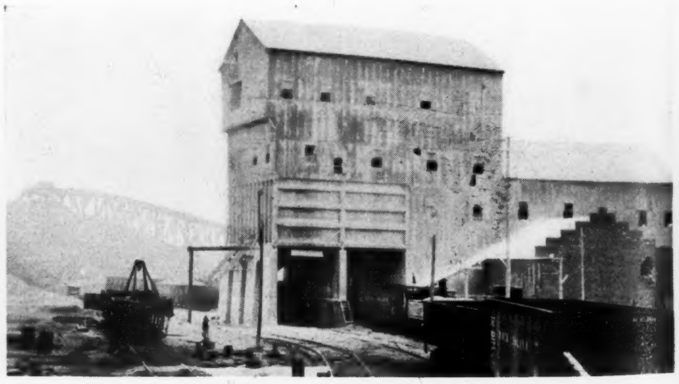
In going down with this lower cut, Sullivan and Chicago Pneumatic wagon-mounted air drills were used, air being furnished by an 11- by 12-in. Worthington motor-driven air compressor. Two motor-driven well drills, one Loomis and one Cyclone, have been used on the upper ledge and are available for the lower ledge later on.

In this new quarrying arrangement the upper 25-ft. ledge will be hand picked to skips or pans handled by a Northwest crawler type gasoline crane and it is intended to empty them over the ledge to the lower level for shovel loading below. The new arrangement should insure clean stone going to the crusher and is expected to materially reduce the amount of stone previously sent to the waste pile.

The crushing plant contains a No. 12K Allis-Chalmers gyratory crusher for the primary crushing, followed by a 36-in. belt bucket elevator and a revolving scalping screen. The oversize from this screen is recrushed in several smaller gyratory crushers and carried up from these and the scalping screen in another 36-in. belt bucket elevator to two 60-in. by 24-ft. Allis-Chalmers revolving screens. These screens have 2½-in. perforations in the main barrel, one jacket of 1¼-in. holes, and one of ¾-in. Any oversize is returned to the recrushers. The minus



Plant at Bridgeport, Texas



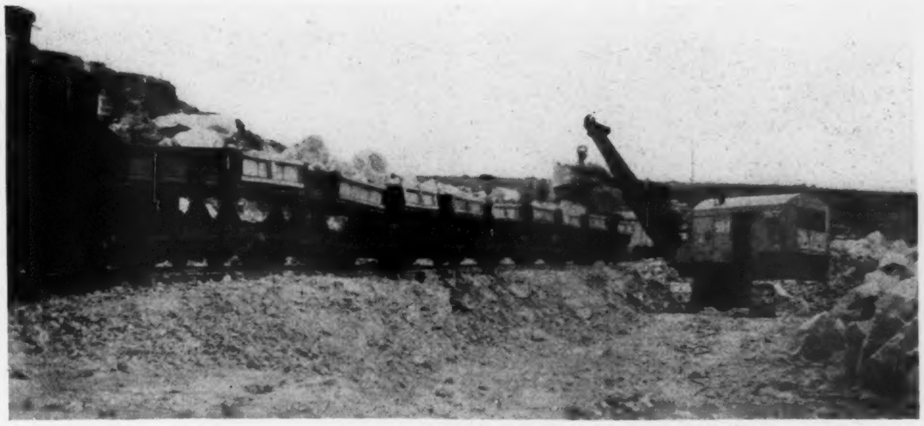
Crushing and screening plant at Chico, Texas

¾-in. material is put over two 3-ft. by 6-ft. triple deck Niagara vibrating screens for separating out the smaller sizes. These screens have ½-, ¼-, and ⅛-in. mesh cloth.

The loading bins extend over two tracks and a 40-ton Vulcan steam locomotive is used for switching at the bins.

The plant was originally steam-driven but is now driven by a 400-hp. 3-phase, 60-cycle, 440-volt, Allis Chalmers motor. It has a capacity of about 1200 tons per 10 hour day.

The Bridgeport plant, which is similar to this, is about 3½ miles from Chico. These plants were built about 1918 and were taken over by the Southwest Stone Co. in 1928. A 3-mi. railroad siding connects the Chico plant with the Chicago, Rock Island and Pacific railway and the Bridgeport plant adjoins the same line.



Electric shovel starting new cut at Chico plant

Knippa Plant

The Knippa plant, formerly known as the Texas Trap Rock Co., was built in 1914 and a primary jaw crusher and belt conveyor were added in 1919. It was taken over by the Southwest Stone Co. in 1925 and changed from steam to electric power in 1927.

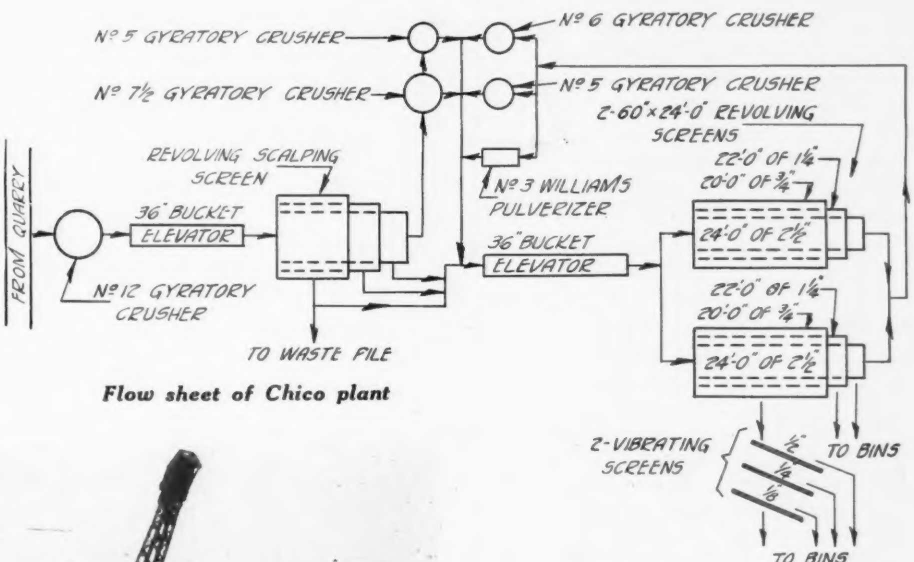
The deposit here is a columnar formation of hard trap rock having a crushing strength up to 37,000 lb. per sq. in. and occurring in a hill rising above the level of the rest of the country.

The present face is variable up to a maximum height of 105 ft. No stripping is necessary, and tunnel blasting has been found more satisfactory than drilling because of the structure and hardness of the rock.

During the past 11 years 26 blasting tunnels have been driven and a map and record kept of all shots. Tunnel No. 27, indicated in the accompanying sketch, was scheduled for shooting about June 1. This tunnel was about 3½ ft. wide by 4 ft. high and was carried back 55 ft. at the level of the quarry floor, then ran parallel to the face for a distance of 75 ft. on one side and 85 ft. on the other.

Tunneling is done by contract at a rate of about $3.75 per lineal ft. using Jackhamers and 3-ft. steels and getting 2- to 2½-ft. per round. After each shot the tunnel is blown out by compressed air.

The present tunnel was to be loaded with 15,000 lb. of Dupont dynamite, one-half 60% and one-half 40%, and it was expected that the shot would bring down about 100,000 tons of rock. The dynamite was to be concentrated at 9 points at intervals of about 20 ft., four on the 75-ft. run and five on the 85-ft. run, with 1500- to 1600-lb. at each point except that each end would be loaded up with about 50% more than that. Only part of the entrance tunnel and the space between the first charges on each side was to be stemmed, the other spaces between the charges being left open. It is believed that leaving these spaces doesn't make any appreciable difference in the explosive action of the dynamite and calculations have indicated that not more than about one box of dynamite is used up in filling these spaces with the compressed gases, so that it is considered much cheaper to stem only enough of the tunnel to prevent blowing out. Both Cordeau and electric exploders are used and are connected into each charge. Most of the dynamite is left in the boxes and piled to fill



Flow sheet of Chico plant

Gasoline crane at Chico plant, handling pans in connection with hand picking

Quarry face of columnar formation at Knippa, showing tunnel entrance for blasting at quarry floor

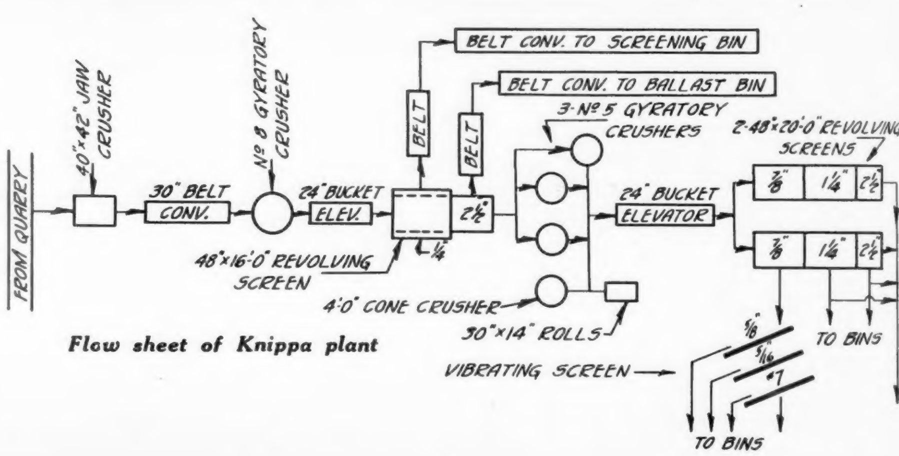
the tunnel, each charge extending along it about 8 ft.

The broken rock is excavated by a model 60 Marion railroad type steam shovel with a 1½-yd. bucket loading to 4-yd. Western side dump cars. Any large pieces are broken up either by "dobe" shots using 60% duPont dynamite or by drilling and shooting in the case of the largest pieces. A 2-cylinder vertical-type 7- by 6-in. Ingersoll-Rand compressor with a direct-connected 25-hp. General Electric motor and automatic start and stop control supplies air for the quarry.

Two trains of 6 cars each are used and are hauled by 18-ton American and Davenport steam locomotives. The cars are left at the foot of an incline and then pulled up to the primary crusher two at a time by a motor-driven drum hoist. Here they are dumped to a hopper and the rock is fed to the crusher through a heavy sliding gate which is raised and lowered by cables from the hoist.

The primary crusher is a 40- by 42-in. Buchanan all-steel jaw crusher, belt driven by a 150-hp. Westinghouse slip-ring motor. From the jaw crusher a 30-in. Robins inclined belt conveyor equipped with a New York belt carries the stone to a No. 8 K Allis-Chalmers gyratory crusher for further reduction, and it is then elevated to a scalping screen by a short 24-in. Traylor belt bucket elevator. The No. 8 crusher is belt driven by a 100-hp. General Electric slip-ring motor, and the conveyor by a rope drive from the jaw crusher.

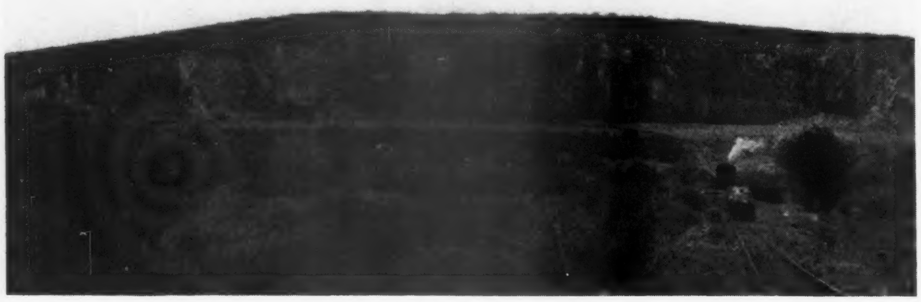
The scalping screen is a 48-in. by 16-ft. Austin revolving screen which is arranged so



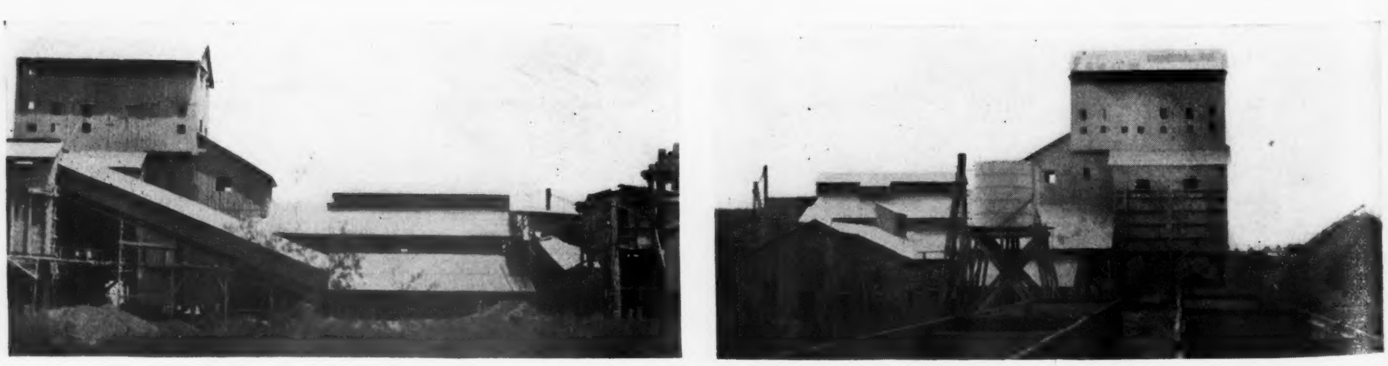
Flow sheet of Knippa plant

that the oversize falls to the rejection crushers, a 2½-in. ballast size to an inclined belt conveyor which carries up to a bin over the loading tracks and the minus ¼-in. material to a second inclined belt conveyor carrying up to a screenings bin. The elevator and screen are each driven by an individual motor through enclosed gearing.

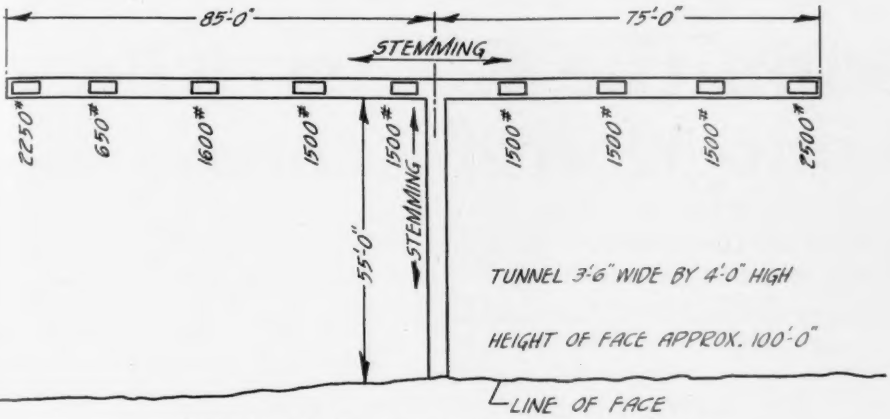
A No. 5 Allis-Chalmers and two No. 5 McCully gyratory crushers are available for recrushing. A 4-ft. Symons cone crusher and a set of 30- by 14-in. Buchanan rolls are also used, receiving their feed from the



Knippa quarry from top of incline at primary crusher



Crushing and screening units at Knippa plant



Method of loading tunnel shot at Knippa plant

finishing screens above the bins. These recrushers are driven from a lineshaft and a 100-hp. General Electric slip-ring motor.

From the recrushers a 24-in. Allis-Chalmers belt bucket elevator carries up to two parallel 48-in. by 20-ft. revolving screens arranged to make additional commercial sizes. The oversize and also the 2½- and 1¼-in. sizes may be returned to the Symons cone crusher. The minus ⅞-in. sizes are further screened and separated by passing over a triple deck Niagara vibrating screen.

The revolving screens are each driven by a 15-hp. General Electric motor through a set of gears, and the elevator is also driven in the same way by its own motor.

The loading bins are built over two railroad tracks, and both bins and building are of timber construction.

The plant is located on the Southern Pacific railway and has a capacity of about 750 tons per 10 hour day. This of course is less than would be expected of a plant of this size and is due to the hardness of the rock and the longer time required in crushing it. Most of the output normally is used as railroad ballast, and the balance is used for road and concrete work.

Personnel

The general offices of the company are at 1611 Santa Fe Building, Dallas. W. F. Wise is president and general manager and H. C. Perry is secretary-treasurer. W. R. Thacker is superintendent at Stringtown; T. F. Sharp, at Chico, and E. O. Jones at Knippa.

High Speed Production on Asphaltic Concrete Paving

A REPRINT of an article, "High Speed Production on Asphaltic Concrete Paving Work," by R. W. Edwards and N. L. James, which appeared in the February, 1931, issue of *Public Roads*, has been published as an 8-page booklet by the Asphaltic Institute.

A resurfacing job in California is described in detail and data are given of various operations on this job, on which the average production for an 8-hr. day was 1,050 tons.

Invention Stops Dust Danger from Drilling

THE INVENTION of a dust eliminator, devised to protect workmen from silicosis, is hailed as a great contribution to industrial safety and also as a boon to mining and construction operations, as it will eliminate the great amount of dust created. The eliminator was invented by George S. Kelley, an engineer of the George J. Atwell Corp., of New York City. It was developed through the activities of the advisory committee on rock drilling, sand blasting and rock crushing appointed by Frances Perkins, state industrial commissioner of New York, in 1929.

Simple Design and Operation of Dust Eliminator

The dust eliminator has a metal hood through which the drill passes. The air sucks the dust, resulting from the bite of the drill, into a pipe, where it is taken into specially constructed metal reservoirs, and there the heavier particles are separated from the fine dust by means of air currents. Finally, it is all settled by means of water sprays and is washed away with the water. —*The Constructor.*

Start Allegheny River Limestone Shipments

AN INITIAL SHIPMENT of limestone from the Allegheny valley was made recently in charge of the Diesel towboat *Winifrede*. This commodity is being loaded into three steel barges at a recently opened quarry above Mosgrove in the eight pool, 53 miles above Pittsburgh, for delivery to the plant of the Davison Coke and Iron Co. at the head of Neville Island. The limestone is deposited in barges by a derrick boat near the quarry, which is equipped to mine approximately 1000 tons daily.

Lock and Dam No. 8, which completes the existing project to provide slackwater for a distance of 61 miles, was opened to navigation about two months ago. On account of the five modern locks, each 56 ft. wide and 360 ft. long, the entire tow can be passed through in one locking, making rapid time until Lock No. 3 at Springdale is reached, where two lockings are necessary. Locks Nos. 1 and 2 are of the same type. These are to be replaced by modern structures, according to plans of United States engineers.

The mines of the Consumers Mining Co. and the Wheeling Steel Corp. at Harmarville are operating at full capacity. The motorship *Benwood* is delivering a tow daily of 5000 tons to the LaBelle landing, where tows are assembled for delivery to the plants at Steubenville.

Another tow of Pittsburgh steel products will leave the harbor Friday in charge of the steamer *J. D. Ayres* of the Union Barge Line. A barge loaded with fluorspar is included in the tow.—*Pittsburgh* (Penn.) *Post-Gazette.*

Wet-Process Cement Made in the Desert

(*Continued from page* 15)

weighed on an automatic weighing machine and carried by belt conveyor to the reinforced concrete storage silos.

The cement is drawn from the silos by a Fluxo pump and conveyed through a pipe to a hopper above the bagging machine. This is a 3-tube Fluxo packer which packs the cement into valve bags of jute or paper.

From the pack house the cement is loaded into cars and is either transferred to boats at the company's dock for shipment up or down the Nile or is shipped by rail on the Egyptian State railways.

Primitive method of unloading cars of raw material

Considerable cement is used in Egypt for modernizing the country, and particularly for irrigation work.

Power Plant

A power plant with three water tube boilers and a 2,500 kw. steam turbine furnishes power for the plant. The condensing water which is pumped from the river has a temperature range from 58 deg. F in the winter to 82 deg. in the summer.

It is stated that the total power consumption of the plant is only 12.7 kwh. per bbl. of cement.

A 250-kw. diesel engine with direct-connected generator is used as an auxiliary and stand-by.

Researches on the Rotary Kiln in Cement Manufacture*

Part XXV—Calculation of the Amount of Water Which Can Be Retained in the Slurry so as to Allow the Exit Gases to Escape at 212 deg. F., Allowing for the Ordinary External Losses Which Occur in a Modern Rotary Kiln

By Geoffrey Martin

D.Sc. (London and Bristol), Ph.D., F.I.C., F.C.S., M. Inst. Chem. Eng., M. Inst. Struct. Eng., M. Soc. Pub. Analysts, F. Inst. Fuels; Chemical Engineer and Consultant; Former Director of Research of the British Portland Cement Research Association; Author of "Chemical Engineering"

IN PART XXIV we calculated the amount of water which could be retained in the slurry to give a given clinker output per pound of coal burnt, the exit gases being kept at the lowest possible temperature capable of getting rid of the steam, viz., 212 deg. F.

In these calculations it was assumed that the kilns were so carefully insulated that all external radiation from the kiln shell was stopped, so all we had to contend with was the internal radiation.

In the present chapter similar calculations are carried out, but in them the kiln is supposed to be losing heat by external radiation to the same amount as occurs in actual practice, as shown by kiln measurements carried out by the British Portland Cement Research Association during recent years.

It is now necessary to decide on the allowance to be made for radiation. In Part XXI the radiation losses from the different zones of a modern rotary kiln were analyzed and were classified as follows:

	B.t.u.'s per 1 lb. standard coal of 12,600 B.t.u. burnt	
(1) From end sections of kiln........	84	553
(2) In the clinkering zone................	210	
(3) In the CO_2 expulsion zone........	259	
(4) In the dehydrating and preheating zone	147	

We may take it, then, that from the hot upper portion of the kiln—above the preheating and dehydrating zone—we lose 553 B.t.u., below 147 B.t.u., for every 12,600 B.t.u. liberated in the kiln when 1 lb. of standard coal is burnt.

These are the figures which will be assumed in the following calculations.

We must now explain the method of performing the calculations. For this purpose we will take a typical case as an illustration. In Part XV it was shown that corresponding to a flame temperature of 3500 deg. F. one could produce 7.570 lb. of clinker per 1 lb. of standard coal burnt. In Part XIX it was shown that the following quantities were associated with this weight of clinker:

Editor's Note

CALCULATIONS of the amount of water which can be retained in the slurry to produce a specific output of clinker per pound of coal burned and still keep the exit gases at the lowest possible temperature to get rid of the steam are made in this part, allowing for external radiation losses of an amount which occurs in actual practice. A table is included which tabulates data of results of computations for a wide range of operating conditions.

Weight of dry slurry required to produce 7.570 lb. of clinker is 11.811 lb.

Weight of CO_2 expelled from the slurry at 1481 deg. F. (805 deg. C.) is 3.965 lb.

Weight of water expelled from the kaolin at 1472 deg. F. (800 deg. C.) is 0.1945 lb.

Weight of water expelled from the silica at 752 deg. F. (400 deg. C.) is 0.0818 lb.

The number of B.t.u.'s required to raise the slurry required to make 7.570 lb. of clinker from 60 deg. to 1481 deg. F.—the temperature of the decarbonating zone—is $7.570 \times 652.5 = 4939.0$ B.t.u. (see Part X).

The exit gas temperature is assumed to be 212 deg. F., and the problem now before us is to calculate the maximum amount of water which may be added to the slurry to maintain the exit temperature at this figure. This we will now proceed to do.

(1) The amount of heat liberated by 11,278 lb. of combustion gas sinking from 1481 deg. to 212 deg. F. without any steam condensing is 3735.4 B.t.u. (see Part XX).

(2) The amount of heat liberated by 3.965 lb. of CO_2 from the slurry sinking from 1481 deg. to 212 deg. F. is (from our heat tables) $3.965 \times 323.428 = 1282.4$ B.t.u.

(3) The amount of heat liberated when 0.1945 lb. of water vapor expelled from the kaolin at 1472 deg. F. sinks to 212 deg. F. without condensing to liquid water is $0.1945 \times 607.523 = 118.2$ B.t.u.

(4) The heat liberated when the 0.0818 lb. of water expelled from the hydrated silica at 752 deg. F. (400 deg. C.) sinks to 212 deg. F. without condensing to water will be $0.0818 \times 252.001 = 20.6$ B.t.u.

(5) Heat brought into clinkering zone by preheated air per 1 lb. of coal burnt is:

Temperature air, deg. F.	B.t.u. carried in
60	0.0
400	828.0
1853	4642.0
2500	6479.0

(6) From the table of internal radiation, given in Part XXII, we get external + internal radiation from clinkering and decarbonating zone into preheating and drying zone per 1 lb. of coal burnt:

Temperature air, deg. F.	Total radiation		
60	1018 + 0	=	1018.0 B.t.u.
400	1018 + 828	=	1846.0 B.t.u.
1853	1018 + 4642	=	5660.0 B.t.u.
2500	1018 + 6479	=	7497.0 B.t.u.

(7) The external radiation from clinkering and decarbonating zone and end of kiln per 1 lb. of coal burnt is 553.0 B.t.u. (assumed as normal for a modern kiln).

(8) The external radiation from preheating and drying zone per 1 lb. of coal burnt is 147.0 B.t.u. (assumed as normal for a modern kiln).

(9) The internal radiation from the clinkering and decarbonating zone into the preheating and drying zone per 1 lb. of coal burnt is:

Entering air, deg. F.	Internal and external radiation	External radiation		Internal radiation
60	1018	553	=	465.0 B.t.u.
400	1846	553	=	1293.0 B.t.u.
1853	5660	553	=	5107.0 B.t.u.
2500	7497	553	=	6944.0 B.t.u.

We then have the following equation connecting these quantities (calculated on per 1 lb. of clinker):

Quantity of heat lost by gases in sinking from 1481 deg. to 212 deg. F. + quantity of heat radiated (or convected) into the preheating and dehydrating zone = quantity of heat required to raise the dry slurry from 60 deg. to 1491 deg. F. + quantity of heat required to raise X lb. of water mixed with the dry slurry from 66 deg. to 212 deg. F. and then turn it into steam at 212 deg. F.

TABLE I. SHOWING THE AMOUNT OF WATER WHICH CAN BE RETAINED IN SLURRY SO AS TO ALLOW THE EXIT GASES TO ESCAPE FROM THE ROTARY KILN AT 212 DEG. F. (100 DEG. C.), ALLOWING THE SAME EXTERNAL RADIATION FROM THE KILN SHELL AS OCCURS IN A MODERN ROTARY KILN

Air supply 10.478 lb. per 1 lb. standard coal of 12,600 B.t.u.			Maximum percentage slurry moisture which enables an exit temperature of 212 deg. F. to be maintained with air entering the kiln preheated to the following temperatures					Radiation losses per 1 lb. standard coal burnt (12,600 B.t.u. per lb.). Internal radiation from clinkering and decarbonating zone into preheating and dehydrating zone					Radiation losses per 1 lb. standard coal burnt (12,600 B.t.u. per lb.). External radiation from kiln shell	
Clinker production: Tons of standard coal per 100 tons clinker	Clinker production: Lb. of clinker per 1 lb. standard coal burnt	Temperature of exit gases	Air at 60 deg. F. Corresponding slurry moisture	Air at 400 deg. F. Corresponding slurry moisture	Air at maximum temperature that it can be heated to by outcoming clinker*: Corresponding slurry moisture	Air at maximum temperature that it can be heated to by outcoming clinker*: Temperature of air	Air at 2500 deg. F.	Air at 60 deg. F., corresponding internal radiation, B.t.u. per 1 lb. standard coal	Air at 400 deg. F., corresponding internal radiation, B.t.u. per 1 lb. standard coal	Air at maximum temperature that it can be heated to by outcoming clinker (see column 7). Corresponding internal radiation: B.t.u. per 1 lb. standard coal	Air at maximum temperature that it can be heated to by outcoming clinker (see column 7). Corresponding internal radiation: Temperature air	Air at 2500 deg. F., corresponding internal radiation, B.t.u. per 1 lb. standard coal	From preheating and dehydrating zone and end of kiln to external air, B.t.u. per 1 lb. standard coal	From clinkering and decarbonating zone and end of kiln, B.t.u. per 1 lb. standard coal
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Deg. F.	Percent.	Percent.	Percent.	Deg. F.	Percent.				Deg. F.			
11.893	8.408	212	0.000	1.40	23.57	(2039)	28.46	....	529	4861	(2039)	6,180	553	147
12.525	7.984	212	0.000	5.35	25.77	(1944)	31.53	85	913	4979	(1944)	6,564	553	147
13.210	7.570	212	3.883	9.326	28.08	(1853)	34.60	465	1293	5107	(1853)	6,944	553	147
13.957	7.165	212	8.03	13.28	30.43	(1764)	37.64	837	1665	5234	(1764)	7,316	553	147
14.791	6.761	212	12.27	17.33	32.89	(1674)	40.72	1209	2037	5356	(1674)	7,688	553	147
15.726	6.359	212	16.57	21.43	35.43	(1584)	43.83	1578	2406	5479	(1584)	8,057	553	147
16.770	5.963	212	20.89	25.50	38.05	(1494)	46.92	1941	2769	5598	(1494)	8,420	553	147
17.960	5.568	212	25.31	29.76	40.78	(1403)	50.08	2304	3132	5716	(1403)	8,783	553	147
19.301	5.181	212	29.73	33.97	43.61	(1315)	53.21	2660	3488	5837	(1315)	9,139	553	147
20.885	4.795	212	34.24	38.24	46.55	(1226)	56.37	3014	3842	5956	(1226)	9,493	553	147
22.660	4.413	212	38.81	42.57	49.60	(1137)	59.55	3366	4194	6073	(1137)	9,845	553	147
24.801	4.032	212	43.46	46.97	52.80	(1047)	62.77	3715	4543	6186	(1047)	10,194	553	147
25.044	3.993	212	43.95	47.44	53.16	(1041)	63.10	3751	4579	6207	(1041)	10,230	553	147
25.278	3.956	212	44.40	47.83	53.49	(1033)	63.41	3785	4613	6220	(1033)	10,264	553	147
25.517	3.919	212	44.87	48.30	53.81	(1024)	63.74	3819	4647	6230	(1024)	10,298	553	147
25.760	3.882	212	45.30	48.70	54.10	(1015)	64.00	3853	4681	6241	(1015)	10,333	553	147
26.021	3.843	212	45.80	49.20	54.50	(1006)	64.20	3889	4717	6254	(1006)	10,368	553	147
26.274	3.806	212	46.30	49.60	54.80	(997)	64.70	3923	4751	6264	(997)	10,402	553	147
26.532	3.769	212	46.90	50.10	55.00	(988)	65.00	3957	4785	6275	(988)	10,436	553	147
26.802	3.731	212	47.20	50.20	55.20	(979)	65.20	3992	4820	6287	(979)	10,471	553	147
27.078	3.693	212	47.70	51.00	55.80	(970)	65.70	4027	4855	6298	(970)	10,506	553	147
27.352	3.656	212	48.20	51.40	56.15	(962)	66.00	4061	4889	6312	(962)	10,540	553	147
27.632	3.619	212	48.60	51.80	56.50	(953)	66.30	4095	4923	6322	(953)	10,574	553	147
27.917	3.582	212	49.00	52.30	56.80	(944)	66.60	4129	4957	6333	(944)	10,608	553	147
28.209	3.545	212	49.60	52.70	57.20	(935)	67.00	4163	4991	6344	(935)	10,642	553	147
28.514	3.507	212	50.00	53.20	57.50	(926)	67.30	4198	5022	6355	(926)	10,677	553	147
28.827	3.469	212	50.50	53.70	57.90	(917)	67.60	4232	5060	6366	(917)	10,711	553	147
29.137	3.432	212	51.00	54.10	58.20	(910)	67.90	4266	5094	6382	(910)	10,745	553	147
29.455	3.395	212	51.50	54.60	58.50	(899)	68.30	4300	5128	6387	(899)	10,779	553	147
29.771	3.359	212	51.90	55.00	58.90	(891)	68.60	4334	5162	6401	(891)	10,813	553	147
30.120	3.320	212	52.40	55.50	59.20	(881)	68.90	4369	5197	6410	(881)	10,848	553	147
30.460	3.283	212	52.90	55.90	59.60	(872)	69.20	4403	5231	6421	(872)	10,882	553	147
34.305	2.915	212	57.70	60.40	63.20	(781)	72.50	4742	5570	6528	(781)	11,221	553	147
39.246	2.549	212	62.60	65.00	66.90	(694)	75.80	5078	5906	6642	(694)	11,557	553	147
45.766	2.185	212	67.16	69.70	70.90	(605)	79.10	5412	6240	6752	(605)	11,891	553	147
54.824	1.824	212	72.60	74.40	75.00	(516)	82.40	5743	6571	6859	(516)	12,222	553	147
70.126	1.466	212	77.80	79.30	79.40	(428)	85.80	6072	6900	6969	(428)	12,551	553	147
90.000	1.111	212	82.90	84.10	83.90	(340)	89.10	6398	7226	7078	(340)	12,877	553	147
131.579	0.760	212	88.20	89.00	88.70	(252)	92.50	6721	7549	7186	(252)	13,200	553	147
243.309	0.411	212	93.60	94.00	93.70	(164)	95.90	7041	7869	7292	(164)	13,520	553	147
1538.459	0.065	212	99.00	99.00	99.00	(76)	99.40	7359	8187	7446	(76)	13,838	553	147
Infinite	0.000	212	100.00	100.00	100.00	(60)	100.00	7972	8800	7972	(60)	14,451	553	147

*There are 10.478 lb. of air at 60 deg. F. entering the kiln per 1 lb. of standard coal burnt, while there are X lb. of clinker (shown in column 2) issuing at 2500 deg. F. This clinker will then be capable, under the most favorable conditions, of heating the air to the temperatures shown in column 6. For list of temperatures corresponding to different weights of clinker, see Part XVII.

Equating these quantities, we obtain the following series of equations: (*a*) *Entering air at* 60 *deg. F.*—

$$3735.4 + 1282.4 + 118.2 + 20.6 + 465 = 4939.0 + 1122.7X + 147.0,$$

whence

$$X = 0.4771 \text{ lb. water.}$$

Hence 11.811 lb. of dry slurry may contain 0.4771 lb. H_2O; or 11.811 + 0.4771 = 12.288 lb. wet slurry may contain 0.4771 lb. H_2O; or 100 lb. wet slurry may contain 3.883 lb. H_2O.

(*b*) *Entering air at* 400 *F.*—Here the internal radiation is 1293 B.t.u. instead of 465. Performing the same calculation as before, we get X = 1.215 lb. of water, or 100 lb. of wet slurry may contain 9.326 lb. H_2O.

(*c*) *Entering air at* 1853 *deg. F.*—Here internal radiation is 5107 B.t.u., and we get X = 4.612 lb. of water, or 100 lb. of wet slurry may contain 28.08 lb. of water.

(*d*) *Air at* 2500 *deg. F.*—Here internal radiation is 6944 B.t.u., and we get X = 6.248 lb. of water, or 100 lb. of wet slurry may contain 34.60 lb. of water.

By repeating this calculation for all the weights of clinker given in Table I, column (3), Part XV, and the associated weights of dry slurry, carbon dioxide, etc., given in Part XIX, Table I, we get a series of values which are set forth in Table I.

Comments on the Table

A study of this table shows that in general the remarks made on the similar table in the preceding chapter can be applied to this table as well, the external radiation being not sufficient in amount to affect the character of the data. In an average rotary kiln the entering air may be taken as being preheated to 400 deg. F. By looking at column 5 of the table it will be seen that if a rotary kiln be fed with slurry containing 38.24% of moisture and the exit gases escaped at 212 deg. F., the fuel consumption of a properly designed kiln should be only 20.855 tons of standard coal per 100 tons clinker, against 30 to 33 tons in the ordinary kiln.

A kiln consuming 30.120 tons of standard coal could bear a slurry moisture as high as 52.40%.

It is obvious, therefore, that it is not the amount of moisture in the slurry which is the effective agent in increasing the fuel consumption of a kiln to the neighborhood of, say, 30 to 33 tons of standard coal per 100 tons of clinker, but some other cause is

at work. This, in the preceding chapters, has been traced to the leakage of high-grade heat (*i.e.,* B.t.u.'s available above 1481 deg. F.) from the hot part of the kiln to the colder parts without performing useful work.

Hence improvements in the efficiency of the rotary kiln must be looked for *not so much in reducing the moisture in the slurry as in increasing the efficiency of the kiln in the hotter regions.*

Limit of Waste-Heat Boiler

Another point which is brought out by the table is the limits of the possible use of the waste-heat boiler, the kiln being supposed to lose heat by external radiation at the ordinary rate prevalent in a rotary kiln at the present time. Unless the exit gases can escape at a higher temperature than 212 deg. F., they cannot generate steam at a technically useful pressure when passed through a boiler.

Since the table gives the maximum amount of water in the slurry which just allows the gases to escape at 212 deg. F., we can see at once what limits are set to the use of a waste-heat boiler when the entering air is preheated to different amounts.

For example, a kiln with a fuel consumption of 11.893 tons of standard coal per 100 tons of clinker could not have any water in the slurry if the air was preheated to only 60 deg. F. If the air was preheated to 400 deg. F., however, a limit to the moisture in the slurry would be 1.40%. If the slurry contained *less* moisture than this, a little steam could be generated.

If, however, the entering air be preheated to the maximum possible amount by the outgoing clinker, the slurry could contain 23.57% of moisture, and yet the gases could escape at 212 deg. F., so that this slurry moisture sets a limit to the employment of the waste-heat boiler here. The slurry moisture must be *below* 23.57% before the waste-heat boiler could be used.

In the ordinary rotary kiln as it exists at the present time, we may consider that the slurry moisture is about 40% and the entering air is preheated to 400 deg. F. Looking at column 5 of the table, we see that when the slurry moisture is 38.24% and the air enters at 400 deg. F., the fuel consumption would be 20.855 tons of standard coal if the exit gases escaped at 212 deg. F. So that under practical conditions a kiln working with a fuel consumption of 21 tons of coal per 100 tons of clinker and a slurry moisture of 40% could not under any circumstances permit of the application of a waste-heat boiler, as the temperature of the exit gases would be too low.

If the amount of water in the slurry is reduced below 40% (other things being held equal), the exit temperature could increase above 212 deg. F., and under such conditions an extension of the range over which the waste-heat boiler can be applied is possible. Even here, however, the range of possible extension is not great, as will be seen later.

(*To be continued*)

Cement Industry in Foreign Countries

Germany. German sales of cement during May showed only a slight seasonal advance over the preceding month. The small increase this year is considered very unsatisfactory by the Cement Association.

Japan. During the first quarter of 1931 Japanese trade in portland cement improved over the confusion of 1930. Curtailment of production and cooperation on sales have had a good effect on business. All companies attempted to reduce costs, with general success.

Latvia. The only cement plant at Riga more than doubled its production in 1930 over that of the preceding year, owing to the completion of improvements by which the processes are modernized. Imports of cement decreased by over 50% and exports were greatly increased.

Sweden. The Stockholm offices of the Swedish cement industry report that the domestic output for May, 1931, was practically the same as that for the preceding months, while preliminary official statistics show a doubling of imports, and a drop of nearly 50% in exports.

During the first five months of 1931 exports came to 174,465 bbl., compared with 349,206 bbl. exported during the corresponding period of 1930. Representatives of the Swedish industry state that this decrease is attributable to the reduced demand from South American countries.

The above information was furnished in a recent bulletin by the Bureau of Foreign and Domestic Commerce on Minerals and Metals. This bulletin also reported under trade opportunities an inquiry, 52896, for cement and builders' plaster from Winnipeg, Canada.

Limestone Industry Expands in Decade

ACCORDING to data collected in the Census of Mines and Quarries taken in 1930, limestone was produced in the United States in 1929 by 1168 enterprises, employing 32,283 wage earners (average for the year) and reporting power equipment with an aggregate rating of 534,923-hp.

In 1919, the last preceding year for which data for mines and quarries were collected by the Bureau of the Census, the number of enterprises engaged in the production of limestone was 895, the number of wage earners employed was 22,069 (average for the year), and the aggregate horsepower rating was 213,717. Of the 1168 returns received for 1929, 889 represent strictly quarrying enterprises, 266 represent only the quarrying operations of establishments which operated finishing plants, or lime or cement plants, in connection with their quarries, and 13 represent combined quarrying and finishing operations of those establishments for which no separate returns for quarrying were received.

The quantity of limestone produced in 1929 by the establishments in the industry was 144,315,000 short tons, valued at $116,539,522, including approximately 336,838 short tons, valued at $3,022,805, for the 13 enterprises that reported the combined operations of quarrying and finishing limestone.

The leading states in the order of production of limestone were Pennsylvania, Michigan, Ohio, Illinois and New York, which accounted for approximately 59% of the tonnage produced in 1929.—*Issued by the Bureau of the Census.*

On Geology of Pennsylvania

A SYLLABUS of Pennsylvania Geology and Mineral Resources is the title of a recent publication of the Department of Internal Affairs, Commonwealth of Pennsylvania, prepared by George H. Ashley. This bulletin, G-1, is said to have been prepared to answer the many requests received by the Geological Survey for general information regarding the state's geology, geological history, mineral resources and geological phenomena in general and to give its citizens a birds-eye view of them.

It takes the place of two bulletins of the preceding survey: Report No. 9, Minerals of Pennsylvania, by Brown and Ehrenfield, and Report for 1906-1908, by the present writer and others, formerly used for answering such questions, but now out of print. It has been largely abstracted from two much more detailed reports now in preparation, one on the "Rocks of Pennsylvania," the other on the "Mineral Resources of Pennsylvania." The first of these was intended primarily to accompany the geologic map of the state to be printed in 1931 but its completion has been delayed in the hope of getting additional light on many unsettled stratigraphic problems. For that reason brief descriptive tables of the rock formations and a preliminary stratigraphic chart have been added to this bulletin. A large part of the text in the first part of the bulletin was published without illustrations in the *Pennsylvania School Journal* for 1927-1928 in 12 chapters. That material is here brought together and illustrated.

There are two appendices to this bulletin, appendix A discussing hunting for minerals and appendix B listing publications of the present geological survey, of the second geological survey, and publications of the United States geological survey.

In Europe

DUFF A. ABRAMS, who recently opened a research laboratory in New York City for studies and consultation on design and control of concrete and other construction materials and for development work in cement and aggregates, left August 15 for a European trip, combining business and pleasure. He will attend the International Congress for Testing Materials at Zurich early in September.

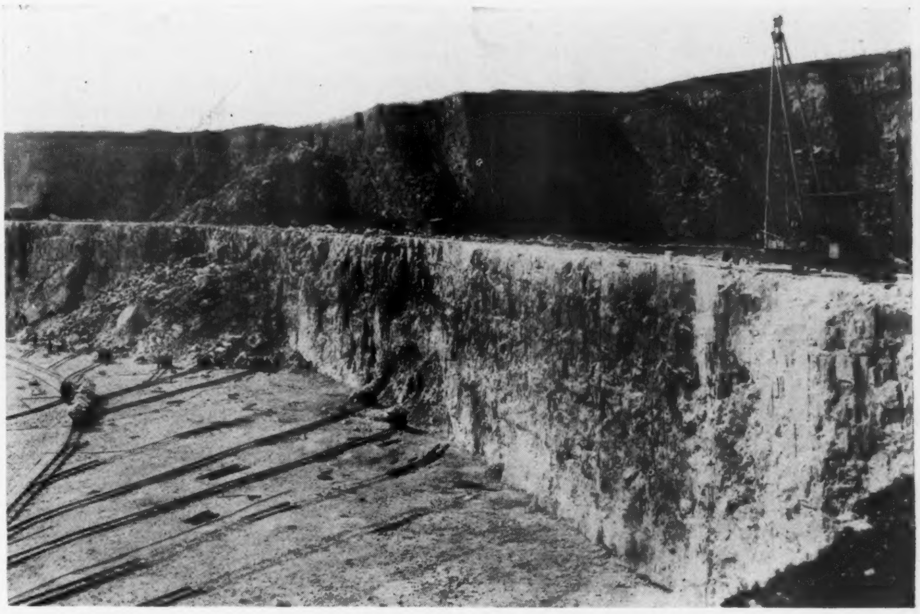
The Lime Industry in England

Part I—Preparation

By B. M. Pearson
Pearson Bros., Cement and Lime Manufacturers, London, England

THE LIME INDUSTRY is closely connected with three of the basic industries of the world, the agricultural, building and chemical industries, and, in addition, the material finds a number of other extended uses. The lime burning industry dates back to the days of antiquity, and perhaps one of its most noteworthy features has been the steady improvement in technique and the regular expansion of the industry to its present large proportions.

The theory of lime burning is not very difficult since a fairly simple physico-chemical reaction is involved, but the practical considerations of the case are not so simple. The physical chemistry of lime burning provides the most practical way of looking at the operation. The thermal dissociation of calcium carbonate is a function of temperature and pressure; under reduced pressure the reaction $CaCO_3 \rightarrow CaO + CO_2$ is effected at a lower temperature. Calcium carbonate will dissociate at a temperature above 900 deg. C.



Buxton limestone quarry, Buxton, Eng., said to be the purest deposit in the world

IN THIS ARTICLE the author deals in a general way with lime-burning practice in England and discusses the production of lime in both shaft and rotary kilns. The advantages and disadvantages of the various systems of burning, particularly as to pulverized coal and gas producers, are also given.—The Editors.

Shaft Kilns

The oldest and simplest type of kiln is the shaft kiln and this may be fired either directly or indirectly.

The shaft kiln is essentially a continuously operating unit and as the name implies, consists of a vertical shaft; it is lined with firebrick, and may be faced on the outside with common brick, or as is more usually done, may be encased by outside steel sheets, or strengthened by steel bands.

Shaft kilns are generally about 40 to 50 ft. high, and the extraction of the burnt lime from the bottom of the kiln takes place at regular intervals. The older types are direct-fired, the limestone and fuel being fed into the top in alternate layers, and small anthracite coal or coke is generally used as fuel. The trouble with such kilns is the inevitable mixing of the burnt lime with the ashes and unburnt fuel and the necessity of hand picking in order to obtain a pure lime. Careful screening of the hydrate after hydration will also purify the material. One advantage of this type of mixed-feed kiln is that a higher concentration of carbon dioxide may be obtained from the top, than from later modifications of the shaft kiln.

Owing to the disadvantages mentioned above, the mixed-feed direct-fired shaft kiln has been considerably modified in design so as to keep the fuel from coming into direct contact with the limestone. This has been done by either burning the fuel on grates let into the kiln, or by gasifying the fuel on an external grate and carrying the gas thus generated into the kiln where it is mixed with additional air and burns to effect the calcination of the material in the kiln.

With the grate-fired shaft kiln, the ash is kept out of contact with the limestone, and remains on the grate. Such kilns are not often made in sizes exceeding 40 ft. in height by 12 ft. in diam. because of the difficulty in securing uniform temperature distribution inside the kiln. This kiln is encased in a steel shell and lined with refractory brick. The upper 5 to 6 ft. is usually left unlined and acts as a storage silo. Some shaft kilns have been built with an outside shell of reinforced concrete. Considerable economies, particularly as regards fuel consumption, may be effected by using insulating brick between the shell and the refractory lining to conserve the heat. In the case of kilns already built, the insulating brick may be placed outside of the steel shell and held in position by wire meshing. Preferably the outside insulating brick is then faced with common brick, to protect it from weathering influences.

The question of draft is an important one with shaft kilns and this point is not always given the attention it deserves. In America, where both induced and forced draft are used, the question of admitting steam under the grates has also assumed a certain importance and remarkable results are claimed for this practice. It has been stated that the steam passing up through the kiln has a catalytic action, but this would hardly appear likely.

The chief advantages from this practice are probably a lengthening of the flame and thus a more uniform temperature distribution inside the kiln, also a greater draft. The flame is lengthened because the grates are converted into semi-gas producers by this steaming and the advantages of gas firing are then largely obtained without its inherent disadvantages. One of the disadvantages in connection with the steaming of the grates is that the steam consumption is considerable, and if improperly conducted the method may prove expensive. The chief point to be said about it is that it provides for a comparatively simple lay-out. A practical advantage of steaming the grates is that the clinker is kept soft and firing is made easier.

Modern progress has brought about increased kiln efficiency by obtaining maximum draft with a minimum of waste heat, a strong draft being necessary for efficient lime burning. Also more attention has been paid to the recovery of the heat contained in the burned lime, this being effected by the use of special lime coolers.

Gas-Fired Shaft Kilns

Gas-fired kilns of the shaft type are now largely used for the preparation of a pure lime, as the difficulties attendant on this type of kiln have been largely overcome and the best working conditions determined. The chief advantages of the vertical gas-fired shaft kiln are fuel economy, and the burning of a high quality lime.

The gas-fired kiln consists of two parts: the kiln proper, and the external gas producer. For reasonably large installations, the use of a modern mechanical gas producer is preferable, and permits of the greatest fuel economy.

The principle of firing a shaft type lime with gas is relatively simple. The gas is formed by blowing air and steam through the fuel bed of the producer and it is then introduced into the kiln through ports at the firing zone. There it meets the preheated secondary air, and, after mixing of the two, combustion takes place.

With gas-firing there are a number of obvious advantages, but there are also a number of snags which are not so obvious. One great advantage is the long flame which may be obtained under suitable conditions, and a further advantage is the non-contamination of the kiln charge. Early designs of gas-fired kilns gave a very considerable amount of trouble due to the partial or complete stoppage of the gas ports and the consequent irregular working of the kiln. Underburned lime issuing from gas-fired kilns has not been an unknown state of affairs. However, with a modern design of gas kiln there is no reason why satisfaction should not be obtained without the necessity of using super skilled labor. Due to the firing conditions gas-fired shaft kilns may be made larger in diameter than a direct-fired kiln, without running any risk of non-uniform temperature distribution and under-burned centers.

Coming now to the economies of gas-fired lime kilns, there has to be considered the capital investment of the gas plant. This, however, is more than offset by the labor which is displaced by doing away with the firing grates.

The gas machine installation should include the necessary coal handling apparatus and storage bunkers. In an installation of this kind, it is generally feasible to generate the steam required for blowing the producer by means of a waste-heat boiler. The efficiency of a modern gas machine will be as high as 80%, which means that 20% of the total fuel used is employed in converting the residual 80% into a combustible gas. In practical language, one-fifth of the fuel is burned before it reaches the kiln. The ability, however, to apportion correctly the combustion mixture of gas and air to give the best results enables the excess air to be cut down to a minimum, and consequently with the producer gas, the utmost firing economy may be obtained.

A simpler static type of gas producer is quite often employed rather than the more expensive mechanical units; however, where the plant is large enough to warrant a mechanical gas producer, the installation of any other design of gas machine is a mistake. The simple static type of gas producer is comparatively inefficient and may be expected to attain only about 60-65% efficiency; further it has only a low rate of gasification per unit grate area and for large kilns therefore a gas making installation is required covering a considerable floor area. The most serious disadvantage of the static gas producer, however, is that the unit can only work with a good quality coal. The mechanical type of gas producer, on the other hand, has been specially designed for burning low grade fuels high in ash, fuels which may in fact be termed waste fuels, and which can consequently be obtained at a very low figure. This ability to make use of low-grade fuels, which cannot be used by any other process, is often lost sight of when considering gas firing.

The alternative is solid fuel firing, and over this system gas firing effects a large saving in fuel costs. With direct firing good working practice is to burn about 3¼ to 3½ tons of lime per ton of coal, whereas in a producer gas fired lime kiln, 5 tons of lime may be reasonably expected to be burned with the expenditure of 1 ton of coal. Furthermore, even by using a fuel unsalable for any other purpose, with a good mechanical type of gas producer, 3 to 3½ tons of lime may be burned with 1 ton of fuel. The economies of gas firing will be further dealt with when considering the rotary lime kiln, in comparison with pulverized systems of firing.

One of the great advantages in connection with the gas-fired shaft kiln is the fact that the installation is admirably suited for unit working. For instance moderate sized chemical plants using a moderate amount of lime can, with advantage, burn their own material in such a unit installation. Gas-fired lime kilns have played a considerable part in the preparation of lime for the calcium carbide industry. Owing to the importance of the kiln draft, only such material as will resist crushing under the weight of the charge is suitable for calcination in the vertical shaft kiln. The material must therefore not crumble unduly during calcination, and should not produce much if any fines during its passage through the kiln. Lump material only is used for shaft kilns, this design of unit being unsuitable for calcining fines. If a chalk is to be calcined, this can only be done in the shaft kiln if the material is strong enough to stand up in the kiln and not disintegrate.

Rotary Kilns

The expansion of the lime industry, necessitating large outputs and the problem of the accumulation of fines at the lime works more than anything else led to the development of the rotary kiln for this work. Briefly the advantages offered by the rotary kiln are the concentration of output in single or dual units and the ability effectively to calcine fine materials. The rotary kiln also lends itself better to plant layout than does the shaft kiln; thus with the shaft kiln special arrangements such as an elevator or a hoist are normally required for charging the kiln.

The charging arrangements for a rotary kiln may comprise a simple feed hopper device fitted with suitable discharge apparatus. Due to the high concentration of output in a single unit, a certain amount of labor is saved with the rotary kiln as compared with a battery of vertical shaft kilns, and, of course, the handling arrangement to take care of the material from a simple unit may be made much simpler and the work itself effected at a lower cost than could be the case with the same output spread over a number of units. Perhaps a slight saving in fuel may be obtained with the rotary kiln, but there is practically no advantage to be hoped for in comparison with an efficiently operated gas-fired shaft kiln.

A more uniform product is certainly obtained from the rotary kiln, as the revolving of the kiln mixes the material more or less and any underburned or overburned material is mixed and distributed uniformly through the correctly burned material. Furthermore, because of the small size of the material being calcined, there is less danger of the heat not penetrating to the interior and of underburned material being produced. A uniform quality is therefore produced from the rotary kiln, as all the qualities produced during the calcination are averaged out.

The average quality of lime produced from a shaft kiln runs about the same as that produced from a rotary kiln, but the lump material from a shaft kiln may be picked to yield a material of higher quality. There is a certain amount of regeneration with the rotary kiln and in addition the air required for combustion may be preheated so as to give quite a good kiln efficiency. If a cooler is used in conjunction with the kiln, a further heat recovery may be obtained by leading the secondary combustion air through the cooler.

A rotary kiln installation may be made to give the utmost possible efficiency by installing a waste heat boiler, through which the flue gases from the kiln are passed. The waste gases leave the kiln at about 700 deg. C. and consequently a considerable amount of heat may be recovered by installing a waste heat boiler. In this way, all the steam

requirements of the plant may be met at a very low cost.

Apart from the actual calcining the rotary kiln has a number of other advantages. The cost of quarrying and preparing stone for rotary kiln burning is less than for shaft kiln burning and, as mentioned above, the labor requirements also are less. The usual method of preparing the material for rotary kilns is to crush the run of mine limestone to about 1¼-in. size and smaller and take out the dust, say ⅛-in. and under.

In England a number of rotary kilns for lime burning have been supplied by Edgar Allen and Co., Ltd., who have also furnished a rotary kiln for lime burning in India. This kiln, which is arranged for pulverized coal firing, is 7½ ft. in diameter by 165 ft. long, and has an enlarged burning zone 8½ ft. in diameter. The lower end is arranged as a cooler for the hot lime which has passed the burning zone and a regenerative effect is obtained by using the combustion air to cool the hot lime and heat the air. The kiln is fired with pulverized coal supplied from a turbo-pulverizer which forces the fuel by air pressure through a long tube projecting past the cooling zone in the kiln.

The kiln is arranged to be fed with crushed limestone of about 1½-in. size and under. It is lined its whole length with firebrick, the lining being about 9 in. thick in the firing zone, but the thickness may be reduced at the feed end. The output of this kiln is from 600 to 700 tons* of burned lime per week, working 24 hr. per day. In this plant two pulverizers were installed, each with sufficient capacity to supply pulverized fuel to the kiln, leaving the other as a standby. The pulverizers are fed with slack coal by an automatic feeder on the machine and deliver the powdered fuel through the burning nozzle at the kiln by means of a blast of air carrying the fine particles of coal. The fan producing the blast is carried on the main shaft of the pulverizer so that the machine is very compact and constitutes a self-contained unit under the control of the kiln operator.

Pulverized fuel firing is eminently suitable for rotary kiln practice as a very long flame is produced by the combustion of powdered coal. This is objectionable for many purposes, but the nature of rotary kilns demands an exceptionally long flame to give the best results. Alternative materials to powdered coal for firing rotary kilns are oil and producer gas. The economics of lime kiln firing have already been dealt with as regards the relative advantages of gas compared to solid fuel firing. Gas firing will now be considered as an alternative to powdered fuel firing for use with rotary kilns. Oil firing can only be practiced in countries having a cheap supply of fuel oil.

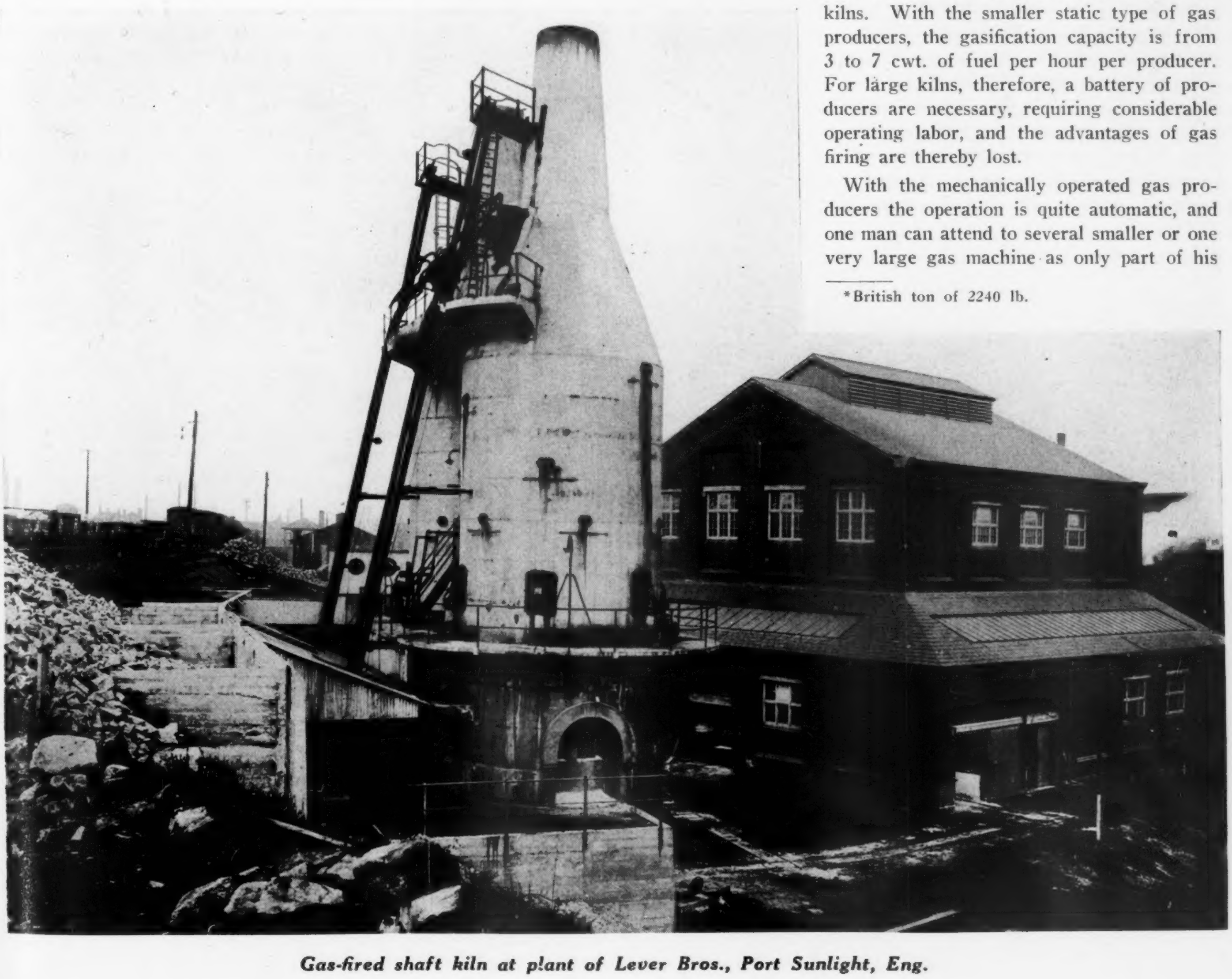
Gas Producers with Rotary Kilns

Gas firing may be advantageously used with the rotary kiln, since the large unit output of the rotary kiln lends itself to the installation of large modern, highly efficient gas making units. The advantages of good firing are not so obvious at first sight, but are apparent after a full consideration of the whole subject. For instance, in the case of the rotary kiln for India having an output of about 650 tons* of burned lime per week, assuming a coal consumption of 4 cwt. per ton* of lime burned in the kiln, more than 110 tons of coal will be required per week or about 16 tons of coal per day. This is about 13-15 cwt. of coal per hour, which is within the capacity of the modern mechanical gas machines.

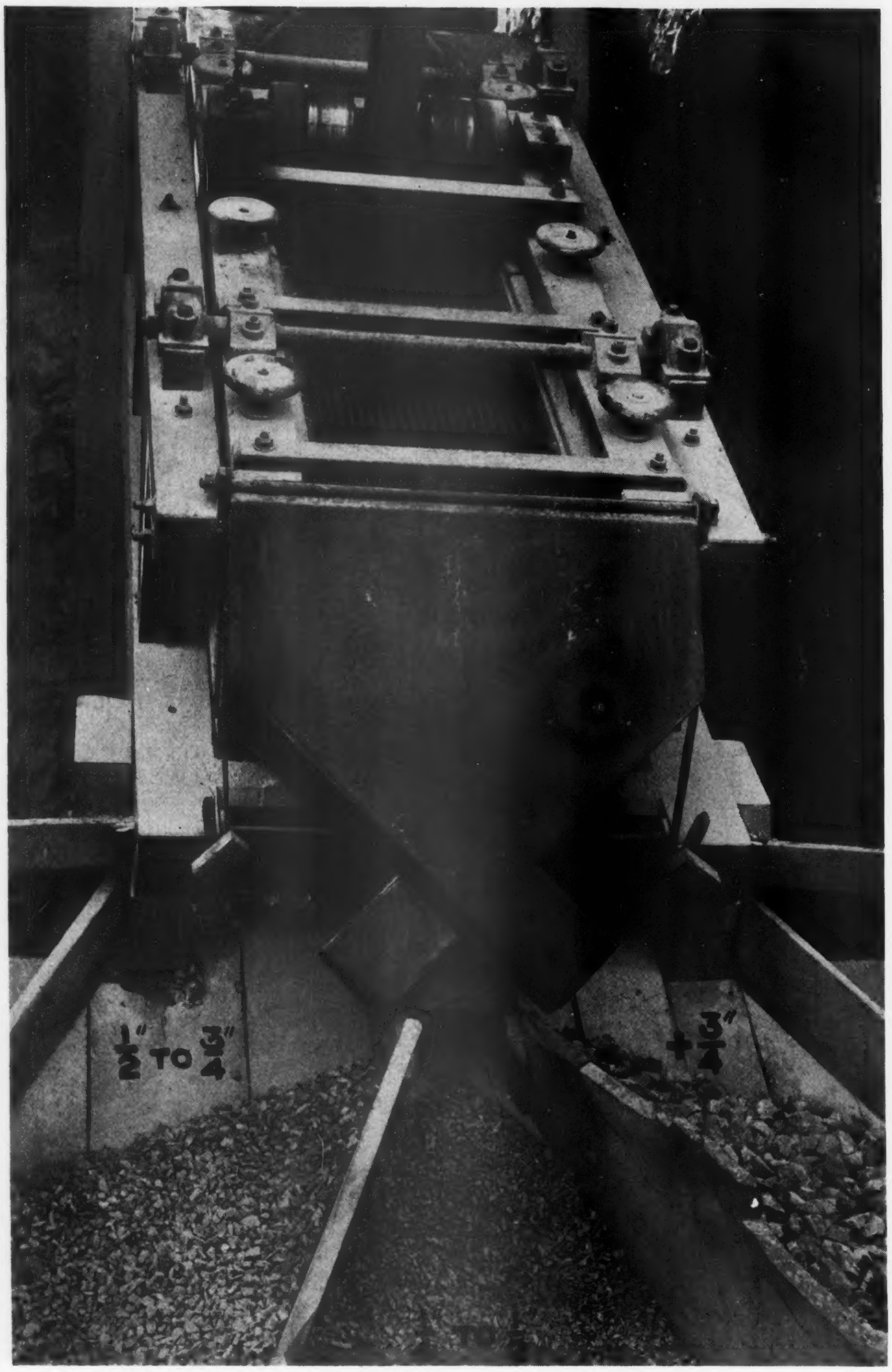
Larger mechanical gas producers, such as the Wellman special heavy duty gas machine, have two or three times this capacity, and so could be used to fire two or three kilns. With the smaller static type of gas producers, the gasification capacity is from 3 to 7 cwt. of fuel per hour per producer. For large kilns, therefore, a battery of producers are necessary, requiring considerable operating labor, and the advantages of gas firing are thereby lost.

With the mechanically operated gas producers the operation is quite automatic, and one man can attend to several smaller or one very large gas machine as only part of his

*British ton of 2240 lb.



Gas-fired shaft kiln at plant of Lever Bros., Port Sunlight, Eng.



Vibrating screen classifying limestone

duties; consequently the gas installation may be attended to by the kiln man. Thus, with a modern efficient gas plant, the labor charges are no higher than with a pulverized fuel firing system; the capital cost of a gas producer installation is higher, but the operating costs are lower with the gas producer than with the pulverized coal installation, as considerable power is required to pulverize the coal.

Modern mechanical gas machines are designed to gasify with reasonable efficiency very low grade fuels which can be obtained at an extremely low price. Claims are made for pulverized coal installations that such low grade fuels may also be used efficiently, but such claims are entirely fallacious, as a little consideration will show. In a pulverized coal firing system, both the coal and ash must be ground, consequently with a low-grade fuel, high in ash, the grinding charges for a given heat value are high. On the other hand, with a modern gas producer operating on low-grade fuel, the working costs increase very little so that by operating the gas machine on a low-grade fuel, which may contain even up to 25% ash, considerably lower operating costs may be obtained.

Special care is necessary in working a rotary kiln in conjunction with a gas producer. Producer gas must be used hot for the best efficiency and as it is difficult to obtain pre-heating of the producer gas from the heat of the kiln, care must be taken that the hot gas leaving the producer does not part with much of its sensible heat and so cool down before entering the kiln. As large rotary kilns may each be operated with a large individual gas producer this may easily be done by placing the gas producer as near as possible to the kiln, and only using very short connecting gas mains. Further, all the steel gas mains should be lined with insulating brick. Well insulated mains allow the gas to be conveyed long distances without losing its sensible heat, and so it is quite feasible to operate several rotary kilns from a central gas producer installation, if such precautions are taken.

Heating Secondary Air

Where a cooler is used in connection with the rotary kiln, this may be used to pre-heat the secondary air for combustion. Firing by producer gas also permits of the production of a very pure lime, as the material in the kiln is not contaminated at all by ash from the fuel. With pulverized coal firing, about 40 to 50% of the ash remains with the lime, so that if a low grade fuel is used an objectionably high amount of impurity may be passed into the kiln. For the burning of sludge from caustic soda plants, etc., pulverized coal firing is not considered satisfactory, as the material is charged into the kiln wet and requires a high fuel consumption for the firing.

The power required for the pulverized coal installation in connection with the rotary kiln is about 16 hp. whereas a heavy duty mechanically operated gas producer requires about 7 hp. The above figures regarding the power requirements of a pulverized fuel plant are abstracted (see Grounds, *The Industrial Chemist*, 8, 1927, p. 351).

The tendency in rotary kiln design is to keep the kiln as large as possible for best efficiency and heat economy. After once being started the kiln is kept in operation as long as possible because the lining may suffer badly due to cracking and disintegration each time it is allowed to cool. The layout of a rotary kiln plant is quite important. Where a cooler is employed, this may be a separate cylinder or may be arranged as a continuation of the kiln in the same straight line. Where the latter is done special arrangements must be made for firing, as the kiln is fired from the end at which the material is discharged. In the case of the rotary kiln for India, considered above, it will be remembered that the firing is accomplished through a long tube projecting through the cooler. Where a separate rotary cooler is employed, the kiln must be raised up some height on concrete foundations, so as to clear the ground and give space for the cooler to be placed below; where the cooler is part of the kiln, this is not necessary.

In cases where a rotary kiln is used in a caustic soda plant for burning the calcium carbonate sludge a complete circulation of the carbon dioxide gas may be obtained. The carbon dioxide of the waste gases from the rotary kiln may be maintained at about 24% if the joint between the kiln body and the burner chamber is kept reasonably tight. For a pulverized-coal-fired kiln, the gas must be scrubbed to remove particles of limestone or coal ash, but for a producer gas-fired kiln a simple filter bag, or for large installations an electro-static precipitator, may be employed.

In America industrialists have been quicker to recognize the advantages of the rotary kiln than in England, and progress has been more rapid. Thus the Eastern Potash Co. is reported to have installed ten 8-ft. by 125-ft. rotary kilns at New Brunswick, N. J., the complete plant to have a capacity of 1000 tons of lime per day.

(Editor's note—This plant was built in 1919 as a result of the potash shortage at that time and was to be used in connection with a process to recover potash from the greensand or glauconite deposits of New Jersey, but has not been operated.)

Other Burning Methods

A special sintering machine has also been developed for the calcination of fines. This machine is built somewhat on the principle of the mechanical stoker. The limestone fines are carried on shallow pallets, set on a traveling grate, and are carried through a combustion chamber. The traveling pallets are provided with perforated bottoms and as they pass beneath the burner in the firing chamber a suction is maintained below which carries the flame down through the charge. Complete calcination is attained in 30 to 60 min. Tests on a small size commercial machine gave a fuel ratio of 5.5 lb. of lime per pound of oil plus 5% of coal which was mixed with the charge. The advantages claimed for the sintering machine are low first cost, low maintenance cost, fair fuel ratio, continuous operation, and ability to use small stone. This special machine is produced by the Dwight Lloyd Sintering Machine Co., Ltd., and is handled in England by Huntingdon, Heberlin and Co., Ltd., of London.

Handling of the Burned Lime

After calcination, the lime may be either packed and dispatched as quicklime, or it may be hydrated (slaked). In the past, users have preferred to take delivery of their quicklime in the lump form because the finely divided quicklime hydrates very easily, and becomes air slaked and carbonated when kept. The tendency now, however, is for quicklime to be dispatched in air-tight bags or drums, and of course finely divided quicklime is more convenient for the user to handle than the lump material. The tendency also is for material from rotary kilns to be shipped unscreened as quicklime.

For hydrating quicklime, care is necessary to produce a satisfactory product. In this connection it should be noted that the fine material from rotary kilns is more suitable for hydrating than the quicklime produced from other designs of kilns. It is interesting to note that limestone which has undergone calcination in a sintering machine from 30 to 40 min. hydrates extremely rapidly. The use of hydrated lime has increased remarkably during recent times, and the technique of the process has been very considerably improved. In America, in 1925, 134 plants produced over 1,500,000 tons of lime hydrate.

Some Considerations in Hydrating Lime

The general practice for hydration carried out in a scientific manner is to mix the requisite amount of water with the lime in special mixing troughs, the water issuing from very fine sprays. After hydrating the material is screened and then elevated into bins where the hydrate is allowed to age for a more or less extended period, generally about 24 hr. This ageing of the hydrate is necessary, to allow the material to thoroughly slake.

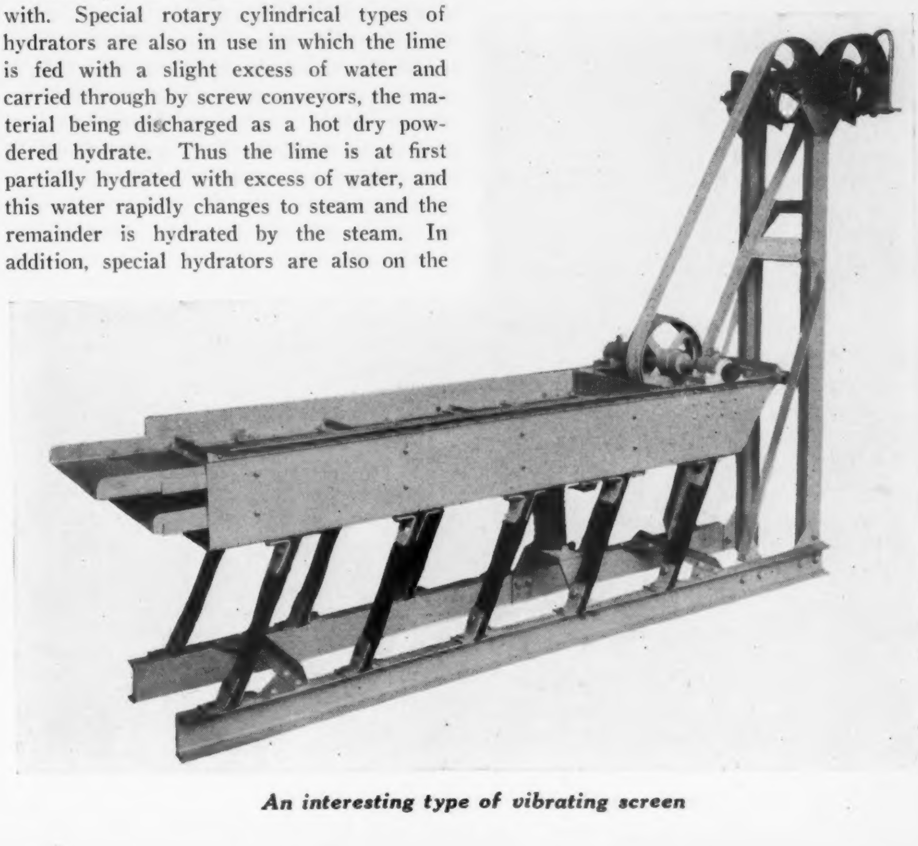
Lime hydrated with an excess of water is finer and settles more slowly than if only the theoretical amount is used. Holmes and others found that (a) the lower the temperature of hydration the finer the product; (b) freshly slaked lime is finer than the commercial hydrate; and (c) the slaked lime is finer if it is allowed to stand in contact with water for some time. If the material is not mixed well during the hydration, local overheating may result, giving rise to what is known as "burning," producing an unsatisfactory coarse hydrate difficult to work with. Special rotary cylindrical types of hydrators are also in use in which the lime is fed with a slight excess of water and carried through by screw conveyors, the material being discharged as a hot dry powdered hydrate. Thus the lime is at first partially hydrated with excess of water, and this water rapidly changes to steam and the remainder is hydrated by the steam. In addition, special hydrators are also on the market in which the hydration is performed by means of steam.

The use of magnesium limestone or dolomite is increasing, and in this connection it should be noted that magnesium oxide hydrates very slowly, and so the material requires considerably longer ageing than usual, if "blowing" is to be prevented.

Tendency to Underground Mining

Recent tendencies in the lime industry have been reviewed by the U. S. Bureau of Mines. One of the most striking tendencies is the increasing trend toward underground mining of the limestone. The advances in calcining technique have already been discussed. The excessive employment of steam under the grates has been discouraged, and it has been found that the same results may be obtained at a lower cost by means of forced draft. Recent practice is to pass some of the kiln gases under the grate; the CO_2 in the waste grate is reduced to CO in passing through the fire, and so gives a longer flame, and better fuel efficiency. The nature of the limestone has been found profoundly to influence calcination practice. Thus porous limestones and coarsely crystalline limestones tend to break up greatly during the burning process; heat readily penetrates dense, non-porous stones giving a shorter calcining period.

For most purposes as pure a lime as possible is required, so that as little contamination as possible of the lime with the fuel should be aimed at. For some purposes, however, the fact should not be lost sight of that contamination of the lime with the ash of the fuel is desirable, as in the case of the hydraulic limes and semi-cements, used in the building industries.



An interesting type of vibrating screen

Some Characteristics of Aggregates, and Methods of Combining for Best Results

New Discussions, Test Data, and Specifications Indicate the Trend to Better Appreciation of Individual Character of Material

By Stanley M. Hands, C.E.

Associate Member A. S. C. E.: Junior Testing Engineer, Division of Highways, State of California

THE AUTHOR explains a method of designing concrete which allows some variation in the coarse and fine aggregates according to their properties and without any sacrifice in quality of concrete. A method of calculating the water demand for different gradings in order to predetermine workability and yield is also given.

The article indicates the newer conception of aggregates, whereby not only their properties but their effect on the mixture is considered, and the efforts being made to fit the mixtures to the materials available, all of which should be helpful to the aggregate industry.

—The Editors.

THE PROCESS of making cemented mixtures imposes certain restrictions upon the use of materials. These restrictions are developed as much on a basis of what the materials will contribute to the mixture as to any other cause. The fundamental requirement of all materials is that they should contribute to the strength, durability, and economy of the finished mass. The proper selection of materials and intelligent design is a primary consideration for quality of a mixture.

There exists at this time considerable variation in opinion as to how to proceed with the design of a concrete mixture. The basic water-cement ratio law seems to be satisfactorily confirmed. There does not exist an equal agreement as to how the materials affect this fundamental law. It seems doubtful that a selected composite expression of conclusions would develop a method such that the quality of concrete could be predicted at the time of fabrication with sufficient accuracy to utilize all the theoretical economy of the materials and the laws governing their combination. There is that challenge to our present methods.

Improvements in quality of all types of concrete will come with a better understanding of the properties of materials. The development of measures to determine the relative importance of the properties of materials is urgently necessary. The effectiveness of cementing ingredients depends upon the materials to be joined. The multiplicity of problems in design of oil, asphaltic and portland cement mixtures are to be solved by "knowing your materials." These have their affinities.

Mark Morris of the Iowa Highway Commission designed a concrete mixture. This is an important bit of news. The design of a concrete mixture in this case was an innovation. Mr. Morris' problem was to correct for certain undesirable results which were frequent where an otherwise excellent concrete making material was used. His problem required the fitting of two materials together to give better results than either would give alone.

The trend of engineering research on concrete is toward a better understanding of the effect of the aggregates upon the mixture. The essence of recent experiments is to establish the character of materials, which is a factor in design. As a result of this work a new conception of the use and value of materials is developing that holds much promise for the future of the aggregate industry. California highway practice is to design the mixture to fit reasonably processed materials.

It would appear that there are many good reasons for the engineer or the producer to have their own ideas about making concrete. The great number of variables which influence concrete quality if considered with material production and transportation problems may be proper cause for differences in practice over a large territory under a single administration. There is no scientific reason why grading and proportions cannot be changed. There may be plenty of economic reasons for these to be changed from time to time and place to place. The facts in every case are all that a qualified practitioner needs to determine upon the best procedure for making concrete.

That property of an ingredient of a concrete mixture which influences the amount of water which must be used to give the correct yield and workability for the mix has been called the "water demand." The normal consistency test for cements indicates

TABLE I. TRIAL GRADINGS AND DESIGN DATA

			Grading of coarse aggregate—Per cent. passing—Mix number						Combined grading of fine and coarse—Mix number					
Screen size	Cement	Sand	1	4	5	6	7	8	1	4	5	6	7	8
2 in.	......	......	100	100	100	......	......	......	100	100	100	......	......	......
1½ in.	......	......	85	85	70	100	100	100	91.5	91.5	84.1	100	100	100
1¼ in.	......	......	70	70	65	85	85	85	82.1	83.1	81.2	91.6	91.7	91.9
1 in.	......	......	60	60	55	73	72	72	77.5	77.5	75.6	85.6	84.6	84.9
¾ in.	......	......	25	35	42	60	48	48	57.9	63.4	68.5	77.9	71.4	71.9
½ in.	......	......	10	12	28	42	26	18	49.4	50.4	60.1	67.8	59.3	55.7
No.														
3	......	100	2.5	4	5	10	5	......	45.2	45.6	47.3	50.5	47.7	46.0
10	......	69	......	......	......	......	......	......	34.8	34.7	35.4	35.6	35.6	36.3
20	......	41	......	......	......	......	......	......	26.2	26.2	26.8	26.7	26.7	27.1
30	......	26	......	......	......	......	......	......	21.9	21.9	22.4	22.2	22.2	22.5
40	......	19	......	......	......	......	......	......	19.9	19.9	20.4	20.1	20.1	20.7
50	......	13	......	......	......	......	......	......	18.0	18.0	18.5	18.2	18.2	18.3
80	......	6	......	......	......	......	......	......	15.7	15.9	16.4	15.9	15.9	16.0
100	100	2	......	......	......	......	......	......	14.2	14.3	14.8	14.8	14.8	14.8
200	90	1	......	......	......	......	......	......	13.1	13.2	13.6	13.2	13.2	13.0
Specific gravity		2.72	2.80	2.8	2.8	2.8	2.8	2.8	......	......	......	......	......	......
Weight per cu. ft		104.4	100.7	101	101	101	101.3	99.8	......	......	......	......	......	......
Per cent. voids		38.5	42.4	42.4	42.4	42.4	41.7	42.6	......	......	......	......	......	......

TABLE II. DESIGN DATA FOR TRIAL MIXES

Mix No.	Proportions Cement	Sand	Rock	Water, lb. per sack	Slump	Water-cement ratio	Void-sand ratio	Yield f.	Cement used per yard	Average compressive strength 10-day	28-day
1	1	1.88	3.70	51.4	2¼-in.	.82	120%	.83	5.99	3723	4008
4	1	1.86	3.68	50.5	¾-in.	.81	120%	.83	5.98	3577	3872
5	1	1.89	3.70	51.4	1 -in.	.82	120%	.83	5.98	3096	3773
6	1	1.95	3.59	52.2	½-in.	.84	130%	.83	5.96	3460	4277
7	1	1.95	3.59	49.5	¾-in.	.79	130%	.83	6.00	3387	4230
8	1	2.02	3.58	48.9	¾-in.	.78	133%	.83	5.96	3915	5483

Note: The first indication that increasing the sand did not increase the water was shown when trial No. 6 was made.

the existence of this property for cements. A similar relationship for materials and oils has been established and measured within reasonably workable units by Hveem and Stanton of California. The ceramics engineer and the paint chemist have recognized some such phenomena as existing for clays, pigment, oil and water. It would seem possible to measure it for concrete with sufficient precision to predetermine workability and yield.

A method of calculating the water demand for materials was developed from a series of tests on concrete which were conducted to determine what range of proportions could be expected if the water-cement ratio and the cement were fixed. It was worked out on the theory that the "best grading curve" is a graphic representation of the character of the materials expressed in screen sizes and percentages. The combined grading shows how the ingredients fit together.

The basis for these tests is a fixed grading for materials, the proportions of which are changed for the purpose of measuring the water which is required to give workability and yield. The method for designing the concrete mixtures is based on determining the absolute volume of the proportions of dry materials and establishing the relation to yield by trial batches. The starting point in calculating the proportions is the voids in the coarse aggregate.

The materials used for these tests were Livermore Valley sand and basalt rock. The sand was prepared on a mixing blanket and the rock was separated into individual screen sizes and remixed in any desired amounts. A number of trial gradings and proportions were used to determine the best combinations for a minimum sanded mixture. The trial gradings and design data are given in Tables I and II.

Grading of the coarse aggregate is more important for securing best workability than the weight per cubic foot or voids. Note the small difference in weights per cubic foot for each grading. There was a distinct difference in workability which was overcome as the sand portion of the mixes was increased.

The procedure for designing the concrete mixtures is as follows:

Let V equal the percentage of voids in the coarse aggregates.

$$V = 100\% - \frac{\text{Weight per cu. ft.}}{\text{Specific gravity x 62.5}}$$

N = the number of cubic feet of rock to be used in the mix.

p = the sand expressed in percentage of the voids in the rock. The sand proportion is NpV and the proportions are $1:NpV:N$. Let d equal the absolute volume of the sand, D the absolute volume of the rock and f the yield factor for the mix and $.45 + dNpV + DN$ = absolute volume of proportions.

$$\frac{\text{Absolute volume}}{f} = 4.5 \text{ cu. ft. for a six-sack}$$

yield. The yield factor is determined by trial.

The grading of rock selected for the final series of tests was No. 7. The voids in this rock when graded according to No. 7 are 41.7% as shown in Table I. The smallest amount of the sand which would make a workable concrete with this grading and six sacks of cement was found to be equal to 130% of the voids in the rock. Therefore, for one cubic foot of rock there must be 1.30 × .417 (voids) = .5421 cu. ft. of sand. It was assumed that 3.6 cu. ft. of rock would be required to give the correct yield. The trial proportions were put up on this proportion but since the yield was not correct for this amount of rock the 3.6 portion was changed to 3.59. Therefore, the sand portion is 3.59 × .5421 = 1.95 cu. ft. of sand. The corrected proportions are 1:1.95:3.59 by volume.

The yield of these proportions can be determined in the laboratory by carefully putting up the mix, being careful to get all concrete off the tools, and weighing in air and water. The weights of the trial specimens are given in Table III.

TABLE III. LABORATORY TEST FOR YIELD

Identification No.	Weight in air, grams	Weight in water, grams	Volume, cu. cm.
1	12,720	7,505	5,215
2	12,800	7,585	5,215
3	12,730	7,550	5,180
4	12,880	7,660	5,220
5	12,730	7,555	5,175
6	12,890	7,660	5,230
7	11,970	7,165	4,805
	88,720	52,680	36,040

The total amount of concrete produced by the proportions 1:1.95:3.59 when mixed on a basis of 1 cu. ft. of coarse aggregate is 36,040 cu. cm., or $\frac{36040 \text{ cu. cm.}}{16.39 \times 1728} = 1.272$ cu. ft. The amount of cement used with 1 cu. ft. of rock when mixed in these proportions is 26.4 lb. If 26.4 lb. of cement will make 1.272 cu. ft. of concrete, one sack of cement will make $\frac{94}{26.4} \times 1.272 = 4.53$ cu. ft. The proportions which were used for this mix were assumed to give 4.5 cu. ft. of concrete. The yield calculation is as follows for these proportions:

		Cu. ft.
Absolute volume cement	1 × .45 =	.45
Absolute volume sand	1.95 × .615 =	1.20
Absolute volume rock	3.59 × .583 =	2.09
Absolute volume of materials		3.74

$$\frac{\text{Absolute volume}}{\text{Yield factor}} = \frac{3.74}{.83} = 4.50 \text{ cu. ft. of concrete.}$$

The yield test, however, shows that the proportions actually made 4.53 cu. ft. of concrete. If the water required to give workability is not changed by changing the proportions the correction is only a matter of adjusting the absolute volume of dry material to give the right yield and correcting the proportions to give the new value. For the trial mix the absolute volume of 3.72 gave 4.53 cu. ft. of concrete but it is intended to produce 4.50 cu. ft. Therefore, $3.72:4.53 :: X : 4.50$. Then X is 3.70, the correct absolute volume, and the yield factor is $\frac{3.70}{4.50} = .822$.

The corrected proportions may be obtained by changing one or both of the aggregate portions. The workability of the trail mix should be observed to see if there is any reason for making all the change in any one portion. If the mix appears to be satisfactory the change should be made in both fine and coarse portions. A good test for the "affinity" of the materials can be made at this stage of trials. If the absolute volume of the yield materials is not changed and the water is not changed, the yield will not change. Therefore, several proportions can be tried to find the mix which is workable with the greatest amount of cheaper material. If the water is fixed the mixes will "dry up" or get wet as the proportion of fine to coarse is varied. If a mix is found that indicates a possibility for less water, a new yield factor must be found, for if the water is changed the absolute volume of dry material must be changed.

The range over which proportions for a material may vary without any great increase in water is useful information. If several proportions are used for the same materials, the "water demand" character will begin to show up at this point in the test. Also any unbalanced condition of supply can be considered in comparing proportions. Since the trial mix was found to be wrong for yield a new proportion must be calculated. If the sand and rock are reduced .02 cu. ft. in absolute volume, the correct proportions are derived from the ratio of the corrected volume to the volume of the component part. The correct sand is $\frac{1.18}{.615} = 1.92$ and the correct rock is $\frac{2.07}{.583} = 3.55$. The new proportions using these materials and

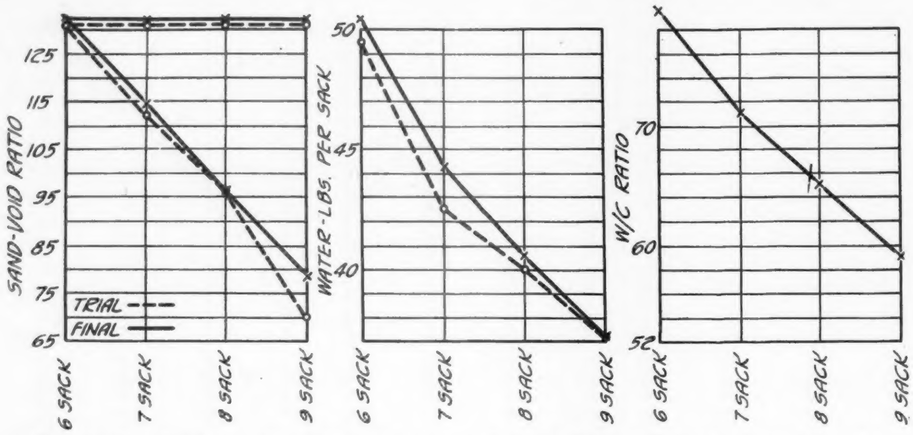


Fig. 1. Sand-void ratio and water per sack for trials and final proportions for 6, 7 and 8 sack concrete mixtures using same materials

six sacks of cement per cubic yard of concrete will be 1:1.92:3.55 by volume and the absolute volume is

$$\begin{aligned} 1 \times .45 &= .45 \\ 1.92 \times .615 &= 1.18 \\ 3.55 \times .583 &= 2.07 \\ &\overline{3.70} \end{aligned}$$

and the yield is $\dfrac{3.70}{.822} = 4.5$ cu. ft. of concrete.

The change in the proportions has changed the ratio of sand to voids in the coarse aggregate and since this is the starting point of this system of design the ratio should be determined for the record. The voids in the rock are 41.7%. In the 3.55 cu. ft. of rock used in the proportions there are $3.55 \times .417 = 1.47$ cu. ft. void-volume in the rock portion. There is 1.92 cu. ft. of sand which is .45 cu. ft. more than enough to fill the voids in the rock. Therefore, the voids are oversanded $\dfrac{.45}{1.37} = 30.6\%$ and the ratio is 130.6%. This completes the design of the six-sack concrete mixture. Seven mixtures were designed for the same materials. The design for the trials for 7, 8, and 9-sack concrete were the same as that just completed for the 6-sack mix. The design data are given in Tables IV and V. The sand-void ratio and water content are shown graphically for these trials and the final mixes in Fig. 1.

Table IV shows the ratio of the absolute volumes of the dry mix to the wet mix. It seems that for the same materials this ratio is the same regardless of the changes in the proportions so long as the mixes show normal consistency with a basic water content for the concrete mixture. Comparing No. 4 and No. 8, which are very near to correct for 9 sacks per cu. yd., the proportions are widely divergent in mortar content. Mix No. 4 contains 29.9% of sand and the "efficiency ratio" is 80.7%. Mix No. 8 contains 21.1% of sand and the "efficiency ratio" is 80.8%. The water-cement ratio for these two mixes is .59 and the compressive strengths in 28 days were for No. 4, 6580 lb. per sq. in. and for No. 8, 6500 lb. per sq. in. The difference in the amount of material used in these two mixes was approximately 300 lb. more sand, but 400 lb. less rock was used in mix No. 4. The final tests show approximately this same relationship.

"Water Demand" May Be Salvation of Some Material Producers

The maximum range over which the sand can be changed without changing the water was not determined for any of these proportions. The range for these materials is not as great for six sacks as for seven sacks and the range seems to increase with the cement. The importance of this relationship of aggregates to water is apparent. The advantages to the producer, contractor, and engineer are numerous. The designer of the mixture may now consider the relative quality of the sand and rock. If the rock is of doubtful soundness and must be used an increase in the sand can be made and the rock decreased so that the percentage of doubtful rock in the mix is a minimum. Therefore, according to recent tentative specifications for tests for the desirability of aggregates, the flexibility of the proportions must be known before the aggregate can be tested for structural soundness by the concrete test method. The aggregate producer who is having trouble in meeting rattler and abrasion tests may find his salvation in the "water demand" characteristic of his own or some other material. The final series of mixes in this test was designed from yield factors corrected from the trials. The tests were run on two cements. The relationship for strength was the same for proportions but the amount of the compressive strengths for one cement was approximately 20% less than for the other.

The engineer may not consider the aggregate plant or the batching plant as his problem. He may say "This is what I want, now let me have it." He may consider this to be the limit of his responsibility to his principal. Refinements that are not covered by the specifications are nobody's business if not the engineer's. Everything, including the aggregate situation, is the engineer's problem. Therefore, if the best proportions for the materials have not been fully determined, the specifications and instructions may not be truly good.

A number of big jobs are being handled according to principles as determined by extended preliminary investigation. This is good and the cheapest engineering practice. A little engineering in advance may save a lot of it later. Government engineers have offered some interesting facts in the specifications for such work as the Owyhee dam.

The engineering profession, if not the individual engineer, is concerned about the inherent concrete-making properties of aggregate and is, therefore, interested, with the producer, in knowing in what way the "water demand" characteristic of the materials influence the design of a concrete mixture. It does not seem that any engineer or architect can justify any arbitrary proportion or grading unless a comprehensive series of tests have been completed to establish such orthodox practice. The members of the profession need not argue about what is to be accepted practice, neither should they continue to do things just as "has always been done." If there is abundant evidence that no one is benefited by continuing to copy from the old specifications or from some other specifications, the engineer or architect who does so cannot justify his position. If new specifications are proposed, the producers serving the territory should be allowed the right of being considered. Any investigation to establish a foundation for designing concrete mixtures which fails to consider producing problems is not complete and cannot be considered as a comprehensive survey.

Producers of concrete aggregates who are likewise producers of concrete realize how and what changes have been and could be made to improve the quality of concrete and the financial condition of those engaged in the industry. It has been stated for the benefit of engineers and aggregate producers that "it was not our ignorance that was hurting us, but rather knowing so many things that were not true." Of course, things

TABLE IV. SUMMARY OF TRIAL PROPORTION QUANTITIES

Series	Proportions	Per cent. sand to void	Absolute volume	Sacks cement per yard	Per cent. sand in mix	Water, lb.	Slump	Water-cement ratio	Ratio absolute volume material dry-wet
				Maximum sanded set of mixes					
No. 1	1:1.96:3.62	130	3.76	6.0	32.0	49.6	1-in.	.79	83.5%
No. 2	1:1.60:2.95	130	3.16	7.01	31.3	45.6	2-in.	.73	81.3%
No. 3	1:1.35:2.48	130	2.74	8.11	30.3	40.2	1¾-in.	.64	81.1%
No. 4	1:1.17:2.15	130	2.42	9.0	29.9	37.4	1½-in.	.59	80.7%
				Minimum sanded set of mixes					
No. 5	1:1.47:3.17	112	3.20	6.85	28.1	42.5	¾-in.	.68	82.5%
No. 6	1:1.12:2.80	96	2.77	8.03	24.9	40.0	1½-in.	.64	81.2%
No. 7	1:0.75:2.60	70	2.42	9.25	19.0	35.3	½-in.	.56	81.2%
No. 8	1:0.85:2.60	78½	2.48	9.0	21.1	37.0	⅞-in.	.59	80.8%

are not generally so bad. We are going right along and getting better at this concrete game. We must not overlook the fact that almost every job is a new challenge. Good concrete can be made and designed from materials having a wide range of sizes and other characteristics. That property of a material which affects yield when used in concrete is now quite popular with researchers and someone is going to get it out in the open to be measured.

Since the water influences the yield and workability of a concrete mixture, it is essential in designing for predetermined strength that the relationships between water and the other ingredients be known. A primary condition for the operation of the concrete quality law is that the concrete shall be mixed to a workable consistency. There is no adequate measure of workability. It has to be visualized.

The design of a concrete mixture entails the condition that the voids be filled. Therefore, the problem of making workable concrete includes the fitting together of particles to give the most compact and easily worked mass. The materials contribute to this condition in different degrees, depending upon their flowability in the dry state. The challenge to design is to get the best workability with the least water.

The manner in which water is attracted to the surface of material is dependent upon the surface characteristic of the material. The materials used in concrete mixtures react to water differently and in some manner allied to preferential adsorption. Water which exists on the surface is hygroscopic. The amount of hygroscopic water is a function of the amount, size and character of the material. This water comprises most, if not all, of the water required for a basic water content in concrete used in pavements. Therefore, if the flowability of two materials to be used in concrete is otherwise the same, the plasticity of the concrete will be increased as the percentage of material carrying the most hygroscopic water is increased. An ideal workable concrete mixture would be secured with well graded materials having a high flowability and carrying only enough hygroscopic water to hydrate the cement.

The intercommunicating but irregular system of capillaries of varying diameters that is formed in a well designed mass of plastic concrete is bounded by the surfaces of the ingredients. The average depth of these channels is related to the position, amount, shape, size and character of the component parts. The volume of water in the mixture when well fabricated is the product of the surface area and the average thickness of the hygroscopic films. If the state of workability for a concrete mixture designed to the basic water content could be measured accurately the amount of water to give this condition could be known for all proportions and materials. Surface areas can be approximated with sufficient accuracy for practical work. Therefore, the film thickness can be approximated from the relation that the total amount of water bears to the hygroscopic water which in volume is the product of the surface area and the film thickness.

This theory has been applied to field concrete in several instances but has not been considered practical in all cases. Most of the criticism against the idea is due to the fact that the practitioner does not have time to make accurate tests to determine surface areas. However, if the grading can be ordinarily well regulated the water demand per unit of volume for the materials can be used to determine the amount of water.

Surface Areas

Surface areas are functions of sieve sizes. The average diameter of the material between two screens is the basis for surface area equivalents. The surface area equivalent is the surface for all particles between screens. The procedure is to sieve the material, using as many screens as possible. The amount of each size is expressed as a per cent of the total. A constant* is assigned for each size that represents the surface area in square feet per pound of the material of the particular size. The percentage for each size is multiplied by the constant for that size and the products added together give the surface area equivalent for the grading represented by the material. Since the surface area table provides for the surface area equivalents for any portion of the combined grading, the surface area equivalents for the component parts of the proportions can be calculated from the proportion $\frac{W \times S}{P}$ where W is the weight per cubic foot of the particle fraction; S is the surface area equivalent of that part of the mix, and P is the ratio of the part to the whole.

*Francis Hveem, Junior Civil Engineer, California Highway Department.

After the surface area equivalents of the component parts have been determined, the next step is to establish a value for the thickness of the hygroscopic film. In the concrete mass this film is distorted and varies in thickness from nothing at points of contact between materials to a maximum in the largest pore space. The average dimension for all these conditions is defined as the water index dimension. Numerically its value is the total amount of water required to produce a normal consistency or basic water condition in the mix divided by the sum of the surface area equivalents of the cement portion plus the surface area equivalent of the sand portion plus the surface area of the coarse aggregate portion. Since this gives rise to three unknowns, it is evident that three equations are needed to solve for the water index of the cement, sand and rock. Assuming that the condition of basic water content of the mix is approximately the normal consistency and that measurement of this is assured, the three equations can be secured from three trial batches of concrete, each designed to give as much range in amount of the parts as possible. All factors affecting the measurement of the amounts of the ingredients must be faithfully observed. The materials must be identical in all but proportions.

After the surface area equivalents of the component parts of the three divergently proportioned mixes is determined, the three equations may be written:

$CA + SA + RA =$ cu. ft. of water per sack of cement in mix 1.

$CA_2 + SA_2 + RA_2 =$ cu. ft. of water per sack of cement in mix 2.

$CA_3 + SA_3 + RA_3 =$ cu. ft. of water per sack of cement in mix 3.

where C is the water index for the cement, S is the water index for the sand, and R is the water index for the coarse aggregate. A, A_2, and A_3 are the values for the surface areas of the component parts of the different mixes. Table VI was developed by Francis Hveem, junior civil engineer of the California Highway Department, to enable field men to derive the approximate surface areas for materials proposed for oil surface roads. This table and the other methods devised for determining the bitumen index for the

TABLE V. COMPARISON OF SAND SERIES

Identification No.	Mix: Cement	Mix: Sand	Mix: Rock	Dry weight of batch: Cement	Dry weight of batch: Sand	Dry weight of batch: Rock	Water: Pounds per sack	Water: Slump	Water: Water-cement ratio	Volume of concrete	Yield *f.*	Sacks cement per yard	Compressive strength: 1 day	2 days	3 days	5 days	10 days	28 da.
1	1	1.95	3.59	564	1220	2185	49.5	¾-in.	.79	27.18	.836	5.96	....	....	....	....	3493	4280
2	1	1.97	3.61	564	1240	2220	50.6	¾-in.	.81	27.00	.836	6.00	502	1165	1757	2333	3912	4932
3	1	1.47	3.17	658	1075	2250	42.5	¾-in.	.68	27.51	.812	6.87	....	....	....	3340	4643	6163
4	1	1.60	2.95	658	1170	2090	45.6	2-in.	.73	26.82	.819	7.05	....	....	....	3705	4103	5633
5	1	1.46	3.08	658	1070	2185	44.4	1½-in.	.71	27.00	.812	7.00	843	1759	2449	3397	4713	5955
6	1	1.61	2.95	658	1178	2090	44.2	1½-in.	.71	27.00	.819	7.00	872	1833	2469	3297	4723	6046
7	1	1.12	2.80	752	906	2340	40.0	1½-in.	.64	26.88	.813	8.04	....	....	....	3585	5225	6483
8	1	1.35	2.48	752	1095	2070	40.2	1¾-in.	.64	26.82	.824	8.11	....	....	....	4383	5015	6318
9	1	1.12	2.81	752	906	2335	40.7	2⅛-in.	.65	27.00	.825	8.00	1073	2021	2750	3727	4975	6410
10	1	1.39	2.54	752	1126	2120	40.7	2-in.	.65	27.00	.824	8.00	1139	2199	2835	2795	5295	6458
11	1	0.75	2.60	846	684	2440	35.3	½-in.	.56	26.30	.805	9.25	....	....	....	4298	5328	6340
12	1	0.85	2.60	846	776	2440	37.0	⅞-in.	.59	27.50	.828	8.85	....	....	....	4215	5598	7175
13	1	1.17	2.15	846	1065	2020	37.4	1½-in.	.59	27.00	.815	9.00	....	....	....	4568	5723	6567
14	1	0.83	2.55	846	757	2200	37.1	1½-in.	.59	27.00	.815	9.00	1258	2458	3198	4170	5442	6750
15	1	1.17	2.15	846	1065	2020	36.6	1¾-in.	.59	27.00	.815	9.00	1436	2620	3583	4405	5822	7100

TABLE VI. SURFACE AREA CONSTANTS FOR DIFFERENT SIEVES*

1			2			3		
Sieves Passing	Sieves Retained	Surface area constants	Sieves Passing	Sieves Retained	Surface area constants	Sieves Passing	Sieves Retained	Surface area constants
200	Less	% × 250	200	......	% × 250	200	......	% × 250
100	200	% × 120	100	200	% × 120	......	......	......
80	100	% × 75	......	......	......	80	200	% × 115
50	80	% × 55	50	100	% × 60	......	......	......
40	50	% × 36	......	......	......	40	80	% × 50
30	40	% × 27	30	50	% × 32	......	......	......
20	30	% × 18	......	......	......	20	40	% × 20
10	20	% × 11	10	30	% × 15	10	40	% × 10
3	10	% × 5	......	......	......	......	......	......
1 in.	3	% × 3	......	......	......	......	......	......
3 in.	1 in.	% × 2	......	......	......	......	......	......

*Note: Reducing the number of sieves will be less accurate.

material have been tested in the field on a number of miles of road constructed under the supervision of T. E. Stanton, materials and research engineer, and Mr. Hveem. Using this table the surface area equivalents for the gradings for the concretes can be determined and the water index calculated for the three equations previously given.

*Instructions for Table VI**

Determine the amount by weight of each size of aggregate by screen analysis. Express these amounts in percentage of the total. Multiply this percentage of the total by the constant for that size as given in the table. Add results which will be the surface area equivalent for this grading in terms of square feet per pound of sample.

If these constants are applied to the combined gradings for mixes 5, 9 and 14, Table V, the surface area equivalents for the component parts of the proportions can be determined from the theoretical combined grading curve. The combined grading curve is obtained by multiplying the percentage of any individual size in the component parts by the percentage that the component part bears to the whole. The additions of these products for each screen give the percentage of this size passing for the whole mix. Table VII gives the calculation in detail for combined grading and surface area equivalent for mix 5, Table V.

Since these calculations are based on relative values, it is assumed that a tolerance for different materials of 5% will not materially change results. Therefore, though the rock contains 5% passing a No. 3 sieve, it is assumed that the water index figures will be sufficiently close if the 5% portion is considered sand. Likewise, the 1.6% of the sand may be considered in the cement. The water-cement ratio for No. 5 was .71, therefore the amount of water per pound of combined materials is .00127 cu. ft. The same process is carried out for No. 9 and No. 14. After the surface area equivalents for the three mixes have been determined and the water per pound of combined mix is calculated, the following equations are set up to be solved for the water index:

Mix No. 5. $40.79X + 5.258Y + 1.427Z = .00127$ cu. ft.

Mix No. 9. $46.15X + 4.465Y + 1.472Z = .001311$ cu. ft.

*Hveem's "Bitumen Index Calculations."

Mix No. 14. $51.39X + 3.797Y + 1.512Z = .001344$ cu. ft.

Then $X = .00000675$ ft., $Y = .000033$ ft. and $Z = .000579$ ft.

The amount of water per sack of cement for the proportions can be determined directly from this water index figure as follows: The cement in No. 5 is 16.8% of the mix and for that portion of the mix the surface area equivalent is approximately 40.79. Therefore, the surface area equivalent of a sack of cement is approximately $\frac{94 \times 40.79}{.168} = 22{,}800$ sq. ft.; the sand was 27.6% of the mix and the surface area equivalent for this portion is 5.258 and, therefore, the surface area equivalent for 1 cu. ft. of sand is $\frac{104.4 \times 5.258}{27.6} =$ approximately 1990 sq. ft., and the rock is 55.4% of the mix with a surface area equivalent of 1.427. The surface area equivalent of 1 cu. ft. of rock is $\frac{101.33 \times 1.427}{55.4} = 262$ sq. ft.

For the proportions 1:1.61:2.95 the surface area equivalents are:

$1 \times 22{,}800 = 22{,}800$ for cement portion.
$1.61 \times 1{,}900 = 3{,}200$ for sand portion.
$2.95 \times 262 = 773$ for rock portion.

The water-cement ratio is the product of the surface area equivalents for the proportions times the water index for the materials. Therefore

$22{,}800 \times .00000675 = .154$ cu. ft. of water for cement portion,
$3{,}200 \times .000033 = .105$ cu. ft. of water for sand portion and
$773 \times .000579 = .448$ cu, ft. of water for rock portion.

The water-cement ratio is thus .707, which compares favorably with the actual value used for the test, i. e., .71, and indicates reasonably close approximations.

The following calculations are for mixes using the same materials but in different proportions:

MIX 10—1:1.30:2.54

$1 \times 22{,}800 \times .00000675 = .154$ cu. ft.
$1.39 \times 1{,}900 \times .000033 = .091$ cu. ft.
$2.54 \times 262 \times .000579 = .385$ cu. ft.

Calculated water-cement ratio.. .630
Actual trial water-cement ratio was .65

MIX 15—1:1.17:2.15

$1 \times 22{,}800 \times .00000675 = .154$ cu. ft.
$1.17 \times 1{,}990 \times .000033 = .077$ cu. ft.
$2.15 \times 262 \times .000579 = .327$ cu. ft.

Calculated water-cement ratio.. .558
Actual trial water-cement ratio .59

TRIAL MIX 6

$1 \times 22{,}800 \times .00000675 = .154$ cu. ft.
$1.95 \times 1{,}990 \times .000033 = .128$ cu. ft.
$3.59 \times 262 \times .000579 = .542$ cu. ft.

Calculated water-cement ratio.. .824
Actual trial water-cement ratio .836

There is a very close relationship between the calculated water-cement ratio and the actual ratio used in the mixes. The tendency of the calculated ratio is to be less than that required for mixes using the maximum amount of sand. This is very probably due to the fact that the mixes from which the water indexes were calculated were those in which the design was based on replacing the sand with the additional cement. The action of the additional cement as a lubricant made it impossible to tell accurately when the mixes were of normal consistency. Again, we need measures.

The interpretation of the water index figure should be debated. However, it does not seem that the amount of water required for concrete is a function of the surface area or voids or both. They may be contributory factors. To say that to add sand to a mix will increase the water is not indicated by these mixes or by the values of the water index for the materials. It does not seem that the voids for the mixes are the same, at least not if close grading and proportioning are necessary to get control of voids. Orthodox explanations are not sufficient and, in some cases, are completely upset by these

TABLE VII. CALCULATION OF SURFACE AREA EQUIVALENT (PER POUND BATCH)

	Percentage passing				Part each	Hveem area	Area equivalent,	Part area		
Screen size	Cement 16.8	Sand 7.6	Rock 55.4	Combined	size	factor	lb.	Cement	Sand	Rock
1½ in.	......	......	100	100	......	......	......	......	......	......
1¼ in.	......	......	85	91.5	......	......	......	......	......	......
1 in.	......	......	72	84.3	.157	2	.314	......	......	......
¾ in.	......	......	48	71.1	......	......	......	......	......	......
½ in.	......	......	26	58.8	......	......	......	......	......	......
No. 3	......	100	5	47.2	.371	3	1.113	......	......	1.427
No. 10	......	69.4	......	36.0	.112	5	.560	......	......	......
No. 20	......	40.6	......	27.9	.081	11	.891	......	......	......
No. 30	......	26.0	......	24.0	.039	18	.702	......	......	......
No. 40	......	19.2	......	22.1	.019	27	.513	......	......	......
No. 50	......	12.8	......	20.4	.017	36	.612	......	......	......
No. 80	......	5.6	......	18.2	.021	55	1.155	......	......	......
No. 100	100	1.6	......	17.2	.011	75	.825	......	5.258	......
No. 200	90	1.2	......	15.5	.017	120	2.040	......	......	......
......	......	......	......	......	.155	250	38.750	40.79	......	......

tests. At least an increase in surface area does not mean that there will always be an increase in water. Therefore, the producer may reasonably expect some comparisons to be made to determine the range of sands which might be used.

It must be admitted that increasing the fines does increase the surface area. If increasing the surface area of the mix does not increase the water in the mix or change the workability, there should be a reason. Several investigators in concrete and paint chemistry have stated that the amount and thickness of the water or oil coating upon materials and pigments is in some manner proportional to the diameter of the particles. It will be noticed that the water index varies with the average diameters of the cement, sand and rock. Mr. Hveem has grouped the different classes of materials and represented them by 10 parabolic approximately parallel curves from which the oil coverage factor can be selected, depending on which curve fits the material. Laboratory tests are made with the materials to find the right curve. Laboratory tests for the water index for concrete materials could also be made. Preliminary tests on materials are always desirable. Table V suggests what information will develop.

If the yield is fixed it is possible to increase the sand without increasing the water. This does not apply to mortars. There must be some other materials present which can be varied with the sand to give the same absolute volume. The limit of the amount that the sand can be changed depends upon the sand and the other constituent, the coarse aggregate.

The trials show the relation of the component parts of the mixtures. Therefore an accurate estimate of costs is possible. The water index enables the engineer to calculate the yield. The water can be approximated from the proportion and forms a proper part of the calculation for absolute volume for the different proportions. If the control practice is good, the yield can be depended upon to be satisfactory within the limits of ordinary error.

The amount of sand in the mix does not influence directly the compressive strength of concrete. The strength of the mortar is not any measure of the strength which may be expected from that mortar relationship when applied to concrete. The tests reported in ROCK PRODUCTS, August 16, 1930, indicate how it is likely that the basic water content changes when the mortar is used in concrete mixtures. The mortars varied in strength when designed to the same consistency. If the mortars were put up with the same water-cement ratio as was used in the concrete, those containing the most sand were the stiffest, but the strengths were the same. When the coarse aggregate is added to the mortar for these mixes the slump changes because the water demand character of the coarse aggregate changes the property of the combination. The basic water content of the concrete is not the same as the mortar. The coarse aggregate can be screened out without changing the strengths under certain conditions, but the resulting residue is much wetter than the original concrete. For the concrete reported August 16, 1930, the water-cement ratio being the same, the mix containing the most sand was the most workable and had the wettest appearance. Certainly in these tests the mortar meant little as to the quality of the concrete or as to how to proceed with the design of the mixture.

Materials which were proposed for use for concrete pavements along the Bay Shore highway south of San Francisco, Calif., were tested for concrete making properties according to the method outlined here. A trial mix was put up for normal consistency. The proportions were 1:1.59:3.75 dry volume. The ratio of the absolute volume of the dry materials to the absolute volume of the wet materials was found to be 83.4%. The batches were designed for 6 sacks of cement per cubic yard of concrete. The absolute volume of the dry materials computed from the proportions is 3.87 cu. ft. per sack of cement. The water required for this mix is:

$1 \times 22{,}800$ sq. ft. $\times .00000675$ ft. $= .154$ cu. ft. water for cement
$1.59 \times 1{,}990$ sq. ft. $\times .000033$ ft. $= .104$ cu. ft. water for sand
3.75×256 sq. ft. $\times .00054$ ft. $= .510$ cu. ft. water for rock

Total water required per sack cement.... .768 cu. ft. water for mixture

The mix was harsh and could be improved by adding sand; therefore a new design was made. Since the yield was satisfactory, the same absolute volume can be used, providing additional water will not be required to give workability. The corrected proportions were 1:1.74:3.61, which gave an absolute volume of 3.87 cu. ft. per sack. The water will be:

$1 \times 22{,}800$ sq. ft. $\times .00000675$ ft. $= .154$ cu. ft. water for cement
$1.74 \times 1{,}990$ sq. ft. $\times .000033$ ft. $= .114$ cu. ft. water for sand
3.61×256 sq. ft. $\times .00054$ ft. $= .499$ cu. ft. water for rock

Total water required per sack cement.. .767 cu.ft. water for mixture

The first mix was slightly harsh with the calculated water, but adding more water would not have eliminated the harshness. The slump was 1 in. The second mix, containing the most sand, slumped 1½ in. Since the water per sack was the same, it would be expected that the strengths would be the same. The compressive strengths for mix 1:1.59:3.75 averages 2603 lb. per sq. in. for 10 days, and 3268 lb. per sq. in. for 28 days. The mix 1:1.74:3.61 averages 2643 lb. for 10 days, and 3453 lb. for 28 days. These mixes were subsequently tried in the field. Mixes designed to 6 and 7 sacks were found to give satisfactory results so far as varying the sand in the proportions might affect the proportions, but the water required for field concrete was less. The range of mixes used in the field was large enough to enable the engineer to calculate the field water index for these materials. The results of these tests and the data covering the design of these field mixes will be given at a later date.

The mix containing the most sand has been found to be the best mix for the engineer and the contractor. It was workable in all respects. The investigation could be carried on to see what advantage there might be for the producer. Assume a market price f.o.b. cars at the producing point of 20c per ton for sand and $1 per ton for gravel. If the freight was 50c per ton, the mixes would compare as follows:

1:1.59:3.75*

$6 \times 1 \times 94$ lb. $= 1.5$ bbl. of cement at $2.20 per bbl.	$3.30
$6 \times 1.59 \times 107$ lb. $= 1020.8$ lb. of sand at $0.70 per ton	.36
$6 \times 3.75 \times 107.2$ lb. $= 2411.1$ lb. gravel at $1.50 per ton	1.81
Total cost of materials per concrete yard	$5.47

1:1.73:3.61*

$6 \times 1 \times 94$ lb. $= 1.5$ bbl. of cement at $2.20 per bbl.	$3.30
$6 \times 1.73 \times 107 = 1110$ lb. sand at $0.70 per ton	.39
$6 \times 3.61 \times 107.2 = 2321$ lb. gravel at $1.50 per ton	1.74
Total cost of materials per concrete yard	$5.43

*Six sacks concrete, 48 lb. of water per sack, water-cement ratio of .77.

Final Comment

If the engineer would follow this method for designing on a basis of preliminary trials the flexibility of the materials could be a factor in selecting proportions. The mix containing the additional sand was satisfactory to the engineer. The producer would increase the sand tonnage 8%, increase the sale value of his sand 16% and reduce the coarse production 4%. Each of these items is in the right direction for a more profitable operation.

Diatomaceous Marl From Western Kansas a Possible Source of Hydraulic Lime*

> ### Editor's Note
>
> ***ROCK PRODUCTS has long been an advocate of the development of an American hydraulic lime industry. Centuries of experience with masonry mortars in Europe have proved hydraulic lime satisfactory and durable.***
>
> ***Undoubtedly limestones from which hydraulic limes could be made are widely scattered over the United States. They have always been rejected as lime-making material in favor of the purest rock available.***
>
> ***Then lime made from the purer rock is often mixed with portland cement to obtain a material designed to have some of the properties of an hydraulic lime. Of course, hydraulic limes will vary in their special properties with the characteristics and analyses of the particular stone from which they are made. But when such properties are favorable they should be capitalized.***
>
> ***Also, hydraulic limes may be made of artificial mixtures of limestone and silica. Probably the silica has to be in some particularly active form, chemically. Nevertheless, there is a tremendous unexplored field to be developed here.***
>
> ***The day will come when we shall develop and design hydraulic cements for the particular service expected of them, just as has been done in Europe. Despite the commercial advantages of one single standard cement, it is illogical to expect such a "standard cement" to best serve a variety of uses, each calling for special properties.—The Editor.***

RAW MATERIALS that appear from preliminary tests to be suitable for manufacture of hydraulic lime have recently been found in Kansas. Since the United States now imports this substance from Europe, the possibility of developing a good domestic source of hydraulic lime has considerable commercial importance. The Kansas deposits that may prove to be such sources are here called diatomaceous marl.

Three localities of diatomaceous marl in Wallace county, Kansas, have been discovered and studied by M. K. Elias, of the Kansas Geological Survey. The largest one, on the Marshall ranch on the north fork of Smoky river, has been called chalk rock by local people and also has been supposed to be volcanic ash, since similar white powder-rock with abrasive or polishing qualities is widely distributed in western Kansas. A microscopic examination under high magnification (300 times or more) discloses the fact that this rock in Wallace county consists almost entirely of the siliceous tests of fresh-water diatoms and of flaky calcium carbonate.

Chemical Characteristics of the Marl

Preliminary quantitative analysis of an average sample prepared from the upper 5 ft., comprising about half of the bed at the Marshall ranch, showed the dry rock with moisture expelled at about 105 deg. C. consists of about 81% of matter soluble in hydrochloric acid. This is chiefly, if not entirely, fine, flaky calcium carbonate. About 90 to 95% of the remaining insoluble part consists of siliceous tests of diatoms, and of siliceous spicules of sponge. Fine to medium grained quartz and with a slight mixture of feldspar constitutes the balance of the insoluble part. Due to the construction of the box-shaped empty tests of diatoms the percentage of the volume occupied by these tests is much greater than the percentage by weight. Roughly estimated, about one-half of the rock by volume is made up of diatoms.

Possible Use

Due to the large amount of calcium carbonate, it is appropriate to call the rock a diatomaceous marl instead of diatomaceous earth. Another reason for this term for the Marshall ranch rock lies in the different practical use which can possibly be made of diatomaceous marl compared with the pure or nearly pure varieties of diatomaceous earth as obtained from southern California and other localities.

The diatomaceous earth which consists chiefly or entirely of the tests of diatoms is a highly porous rock and is used now chiefly as a sound and heat insulator in building construction, as a filter for purifying drinking water and in other cases where high porosity, neutrality to acids, or hardness and sharpness of the minute tests of diatoms are of advantage. The rock from the Marshall ranch might be regarded as a diatomaceous earth mixed with a large amount of flaky calcareous matter. It is softer and much less porous than ordinary diatomaceous earth and not at all neutral to acids. Thus, though the diatomaceous marl of Wallace county can probably be used in some cases where diatomaceous earth is now applied (for instance, as sound and heat insulators, as an abrasive, etc.), it is obviously an inferior material compared with the purer grades of the latter. On the other hand, the intimate mixture of the diatomaceous tests with calcium carbonate appears to have peculiar useful properties of its own which will decide its place and its value among other mineral resources of this country.

It was noticed in some limestones of Europe that when the amount of silica, and to a much lesser extent alumina and some other impurities in these rocks, is increased to about 12% or more, lime manufactured from them begins to acquire the property known as "hydraulicity," that is it can harden or "set" under water. The natural cement which is made of these limestones is known as "hydraulic lime." Hydraulic lime is white and in this and some other important respects differs from the ordinary yellow or brown natural cements of the "Roman cement" type, which contain a much smaller amount of calcium carbonate and in which alumina and iron constitute a considerable part. A typical natural cement of this latter kind is manufactured at Fort Scott, Kan. The limestone from which the Fort Scott hydraulic cement is made contains: Silica 18.09%, alumina 3.44%, iron oxide 4.27%, lime 35.32% and magnesia 4.62% (average analysis, Eckel—8).

The most famous and typical hydraulic lime is that known as Le Teil or La Farge, made from a limestone found in Ardèche, France. This limestone consists of calcium carbonate very intimately intermixed with finely divided silica. It contains very little alumina and oxide of iron, which are the constituents generally necessary to bring about the union of silica and lime to form a cement, but in spite of this the silica is so finely divided and so well distributed that it unites readily with the lime when the limestone is burned at a sufficiently high temperature. When, subsequently, a little but proper amount of water is poured in, it slakes or disintegrates into fine powder and thus does not need to be ground, which is an unavoidable expense in the manufacture of ordinary cements of both the portland and the natural cement (Roman) types.

As has been said, the Wallace county diatomaceous marl is a chalky substance with about 18 to 19% silica. It is composed chiefly of very fine tests of diatoms intimately mixed with flaky calcium carbonate. There may be a trace of alumina. It remains to be seen if the two most important components of the Marshall ranch rock, calcium carbonate and silica are fine enough and mixed intimately enough to produce a good natural hydraulic lime after being burned.

One hundred pounds of the diatomaceous marl from the Marshall ranch has been

*State Geological Survey of Kansas, University of Kansas, Lawrence, Kan., Circular 3.

shipped by the Kansas Geological Survey to the United States Bureau of Standards, which agreed to make tests in order to find if the rock can be used for manufacture of hydraulic lime. The experiments of the Bureau of Standards are not completed, but preliminary study shows "from the work up to date it would appear that this material can be burned so as to produce a lime having hydraulic properties."†

Peculiar Properties of Hydraulic Cement

Hydraulic lime has some properties which make it different from portland cement and from natural hydraulic cements. It sets more slowly than these cements but ultimately becomes as strong as portland cement. The slow setting is an advantage for some special purposes, as for foundations and abutments where settling may occur. The structure is free to take its permanent position before the lime sets, and cracks are thus avoided. It is used, for instance, in place of portland cement as grouting outside the cast-iron tubes used for lining tunnels made by the shield system. Being low in iron and soluble salts, hydraulic lime is light colored and does not stain masonry, having thus a fair market for architectural uses in cities, especially in the east and southeast of the United States, where a considerable amount of this cement is now imported annually (8).

The available American or French literature lacks precise description of lithologic characters of the Le Teil marl, but the reported chemical constitution is almost identical to that of the Marshall ranch diatomaceous marl. The following are analyses of some European limestones from which hydraulic lime is manufactured (8):

ANALYSES OF LIMESTONES USED FOR HYDRAULIC LIME

	Le Teil, France		Senonches, France	Hansbergen, Germany
Silica (SiO_2)	12.40	16.80	17.00	11.03
Alumina (Al_2O_3)	0.60	0.81	1.00	3.75
Iron oxide (Fe_2O_3)	0.50	trace	not determined	5.07
Lime (CaO)	47.49	45.40	44.80	43.02
Magnesia (MgO)	not determined	not determined	0.71	1.34
Carbon dioxide (CO_2)	37.31	35.67	35.99	35.27

The Marshall ranch diatomaceous marl is a fresh-water deposit of Lower Pliocene age, while the siliceous marl of Le Teil constitutes the Criocera marls of the marine Lower Neocomian of the Cretaceous. The source of the finely distributed silica in the beds from Le Teil is unknown. The possibility of the presence of diatoms in these rocks is not excluded, for the tests of these organisms are known in marine Cretaceous limestones of European Russia and California.

Marshall Ranch Deposit

The Marshall ranch diatomaceous marl outcrops on the south side of the north fork of Smoky Hill river in sections 10, 11 and 12, T. 11 S., R. 38 W., Wallace county, and extends into section 7, T. 11 S., R. 37 W., Logan county. The total length of the exposures, interrupted in places by loess, is slightly more than three miles. The thickness of the bed ranges from 2 or 3 ft. in the middle of section 11 to 11 ft. in the eastern part of this section. The average thickness from here to the easternmost exposure in Logan county is about 7 ft. In the western half of section 11 the diatomaceous marl is more limy and hard, but in the northwest quarter of section 10 it is somewhat softer. On the top of the bed there is nearly always a thin hard ledge of white limestone, usually full of small cavities representing molds of fresh-water gastropods. This limestone is a few inches to 1 ft. thick. At the base of the diatomaceous marl there is generally a light gray clay with some mixture of calcareous matter and diatoms, but locally there is greenish sand in place of clay at the base. A number of mammalian and other bones have been found in this sand.

The constitution of the diatomaceous marl is fairly uniform throughout. It is always a snow-white chalky rock, light and very fragile. However, it resists weathering and together with the capping thin limestone forms low cliffs and benches on the southern slope of Smoky river valley. In a few places erosion has formed separate cliffs of the diatomaceous marl which are scattered on the smooth, gently descending slope of the valley. The rock is usually massive and is cut by widely spaced vertical joints into large blocks. However, it has also a distinct horizontal stratification and can be broken with comparative ease along the closely spaced bedding planes.

The overburden above the diatomaceous marl consists of the thin hard limestone and in some places of nearly 15 ft. of Ogallala grit, slightly cemented by calcium carbonate. Above this lies gravel and loess of Pleistocene. The specific gravity of air-dry rock is about 1.53, which is approximately three times greater than that of pure diatomaceous earth from California.

Two other outcrops of diatomaceous marl in Wallace county have been studied. One that was shown to Elias by Jas. T. Madigan is in the SE. ¼ of SE. ¼ of Sec. 35, T. 11 S., R. 39 W., at the very head of one of the numerous draws on the south side of Lake creek. The soft, snow white diatomaceous marl, of apparently the same qualities as that of the Marshall ranch, makes here a small inconspicuous outcrop. The small size of the outcrop is probably due to the absence of the hard limestone at the top of the bed. The thickness of the outcropping rock is about 3 or 4 ft., but neither the base nor the top are visible. A few feet above the outcrop loess can be seen in the bluffs at the head of the canyon, while below and somewhat down the canyon a few outcrops of Ogallala grit can be observed.

A Deposit of Different Color and Texture

The third locality of diatomaceous marl and the one in which the diatoms were first recognized by Elias in 1928 is in the NE. corner of NW. ¼ of Sec. 29, T. 12 S., R. 41 W., about one-half mile east of the Collins ranch. The diatomaceous marl of this locality is of somewhat different color and texture. It is light gray in color and softer than the rock from Marshall ranch. There is probably less calcium carbonate and more diatoms and there is a mixture of clayey material in this rock. The bed is 4 ft. thick. It is slightly harder at the top and is capped by limestone partly silicified into compact, tough chert. The bed is underlain by greenish-gray clay. The lateral extent of the bed seems to be insignificant.

Soft, light-colored rocks in which diatoms constitute a considerable part are known in southwestern and western Nebraska (2, 3) and in Beaver county, Oklahoma (5, 6, 7), from which locality they probably extend into Meade and Seward counties of southwestern Kansas. According to Adams (1) the soft chalky limestone, which he compares with the diatomaceous deposit of Beaver county, is exposed on both sides of the Cimarron river in Seward county, Kansas, and is there 10 ft. thick.

Bibliography

1. *Adams, George.* 1902. Note on a Tertiary Terrace New in Kansas Geology: Amer. Geo., Vol. 29, p. 301.
2. *Barbour, Erwin H.* 1896. Diatomaceous Deposits of Nebraska: Nebraska Acad. Sci., Pub. 7.
3. *Barbour, Eleanor.* 1910. Preliminary Notice of a Newly Discovered Bed of Miocene Diatoms: Nebr. Geol. Survey, Vol. 3, Part 12.
4. *Berry, E. W.* 1917. Fossil Plants from the Late Tertiary of Oklahoma: Proc. U. S. Natl. Mus., Vol. 54, p. 627.
5. *Buttram, Frank.* 1914. Volcanic Dust in Oklahoma: Okla. Geo. Survey, Bull. 13.
6. *Case, E. C.* 1894. Geological Reconnaissance in Southwest Kansas and No Man's Land: Kans. Univ. Quart., Vol. 2, p. 143.
7. *Cragin, F. W.* 1891. On a Leaf-Bearing Terrane in the Loup Fork: Amer. Geol., Vol. 18, p. 29.
8. *Eckel, E. C.* 1928. Cements, Limes and Plasters: John Wiley & Sons, New York.

†Letter of Bureau of Standards, December 29, 1930.

Wire Cloth, Screening and Netting

A RECENT PUBLICATION by the John A. Roebling's Sons Co., Trenton, N. J., gives detailed information on wire cloth, wire netting and wire screening. The U. S. Bureau of Standards Specifications for sieves are shown. Methods of measuring these materials are illustrated. The products described are used in testing sieves, on production equipment, and in many other places.

Taking Advantage of Present Conditions to Make Plant Improvements

Erie Sand and Gravel Co., Erie, Penn., Believes in Being Forehanded

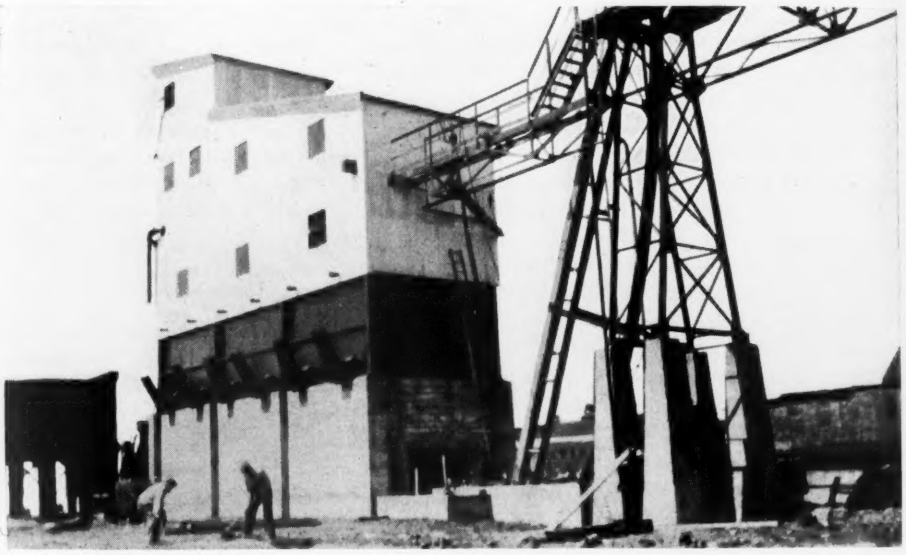
By Ralph P. Brown
Cleveland, Ohio

Foreword

WHAT FOLLOWS was written for the personal consumption of the editor, not for publication, but it forms an excellent foreword to this little story and should be published, too. Mr. Brown wrote:

"On my recent trip to Buffalo I called on a number of sand and gravel producers in an attempt to get a business summary. However, the producers were so pessimistic, with a couple of exceptions, that you would not have been interested in an article. Their story seemed to be, 'Business is rotten, prices are worse, trade conditions are all upset, and we are just waiting.'

"However, the Erie Sand and Gravel Co. did not bewail conditions, and these operators are going ahead in every sense of the word. I am enclosing a short story of the construction of their new grading plant, together with a number of pictures. Some of these I took during construction, and some were furnished through the courtesy of E. S. Williamson, general manager of the company."



Construction view of grading plant elevator to storage conveyor

THE Erie Sand and Gravel Co., Erie, Penn., believes that this is a good year to build and has been taking advantage of the present low prices and quiet business conditions to completely remodel its dock and storage facilities and get ready for the increase in business which it sees coming for specification material. At present it is dredging from special beds which are remarkably well graded, but it foresees the time when these beds will not supply the demand and consequently is getting ready to fill the orders when they start coming in volume.

Construction of tunnel under raw storage

Providing for the Future

Under the new plan the 650-yd. capacity dredge, *Frank C. Osborn*, will be unloaded to a stock pile by two 25-ton locomotive cranes equipped with 2½-yd. Williams clamshell buckets and from this stock pile the material will then be reclaimed on a 20-in. belt conveyor running in a 155-ft. reinforced concrete tunnel below the pile. This conveyor is driven by a 7½-hp. General Electric motor through a 75DX Foote Bros. reducer direct-connected to the conveyor headshaft and discharges to a 9-in. by 21-in. Telsmith crusher, driven by a 15-hp. General Electric high torque motor through a V-belt drive.

From the crusher, the material is carried up by a No. 6 Telsmith belt bucket elevator to a bar grizzly screen 30 in. wide by 4 ft. 6 in. long, with 1¼-in. openings. The elevator is driven by a 15-hp. General Electric high torque motor through a 100DX Foote reducer direct-connected to the elevator headshaft.

Oversize material from the grizzly is returned through a chute to the jaw crusher, while that material passing through the screen is flumed to a 3-ft. by 8-ft. Telsmith balanced double-deck vibrating screen. The top deck has ¾-in. perforations, while those on the lower deck are ⅜-in. This vibrating screen is driven by a 5-hp. General Electric motor through V-belt drives. Coarse and fine gravels are chuted directly to their respective bins.

Sand ⅜-in. and under is flumed into a No. 7 Telsmith sand-settling tank which takes out the coarse sand. The overflow from this tank is flumed into a No. 8 tank of the same make, which takes care of the fine sand. The chutes have been so arranged that sand from both tanks can be mixed at any time as desired.

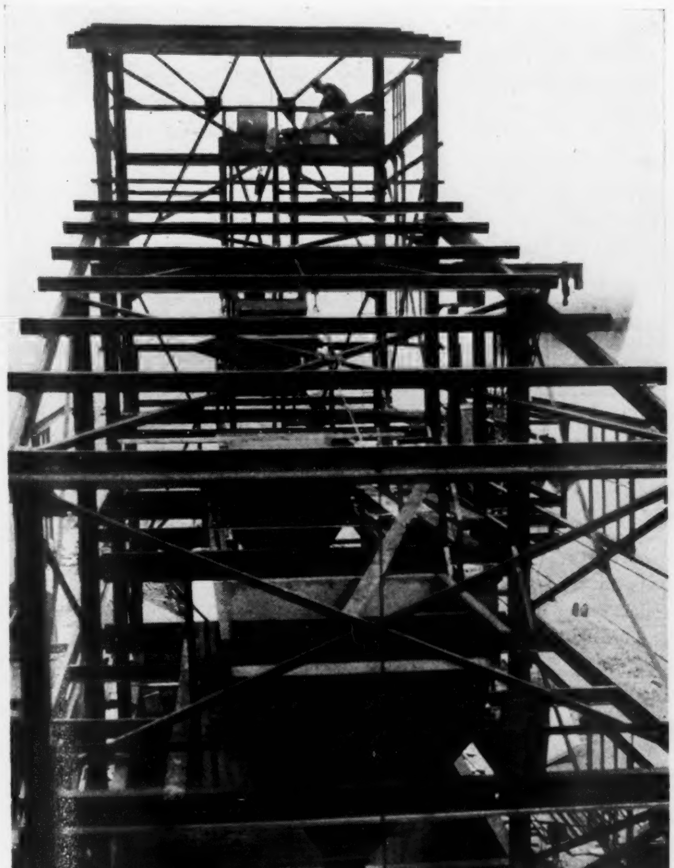
Five Sizes of Material

Arrangements are such that three sizes of sand can be produced, fine, mason's and coarse; and two gravel sizes, ¼-in. by ¾-in. and ¾-in. by 1¼-in. From the bins below the screens and settling tanks these different sizes are handled to storage piles by belt conveyor and elevator and stocked in different sizes.

Material from these bins is fed through regulating gates to a 20-in. belt conveyor below and then elevated to a conveyor above the storage piles. This lower conveyor is driven by a 3-hp. General Electric motor, direct-connected to the head-

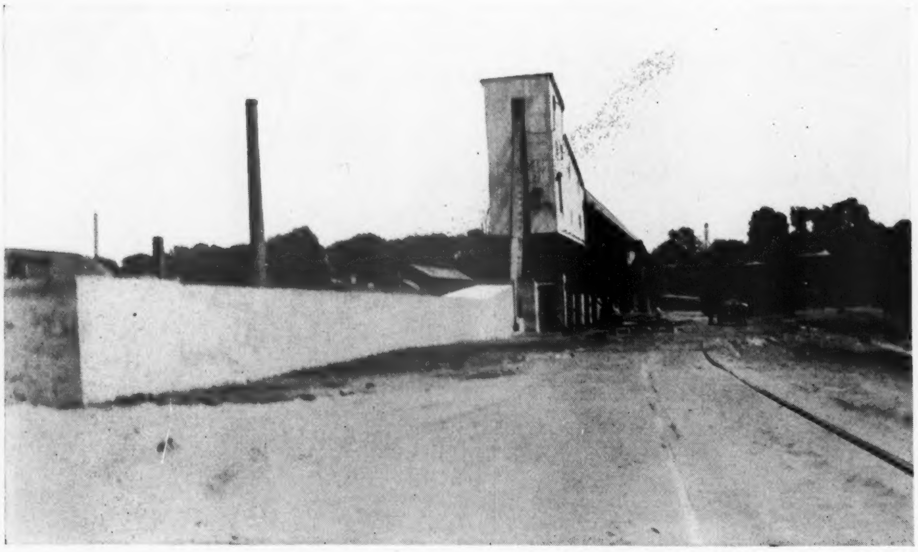
Elevator from graded sand bins to dead storage conveyor

Trestle on which the dead storage conveyor is carried



Installation of sand settling tanks

Discharge tripper on conveyor belt



Concrete tunnel over which raw storage piles will be built

shaft through a 50DX Foote reducer and discharges to another No. 6 bucket elevator 52 ft. long which carries it up to the storage conveyor. The elevator is driven by a 15-hp. General Electric high torque motor direct-connected through a 100DX Foote reducer to the headshaft.

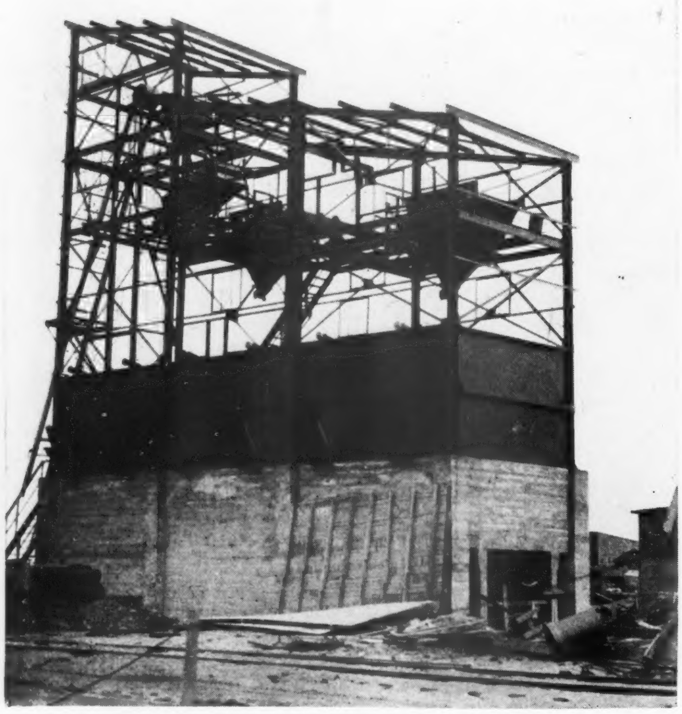
Three-Way Automatic Tripper

The conveyor above the storage pile is 20 in. wide by 250 ft. long and is driven by a 10-hp. General Electric motor through a 75DX Foote reducer direct-connected to the headshaft.

This conveyor is arranged with a full automatic tripper with three-way discharge spouts for distributing to the piles below and has a 4-ply Goodyear rubber belt running on Stearns roller bearing idlers. This conveyor is supported on a steel frame on steel bents spaced 62½ ft. apart and is 35 ft. above the top of the dock. The stocked materials are reclaimed by a Browning locomotive crane with 1½-yd. clamshell bucket.

The end drive-house is built to provide for future extension in the form of another conveyor at right angles to the present one. Members are provided between the columns so that future floor beams, machinery supports, flooring, and stairway may be installed without dismantling the structure. All construction work was done by the Pittsburgh Engineering Foundry and Construction Co., Pittsburgh, Penn.

R. W. Potter is president of the Erie Sand and Gravel Co.; R. C. McClenathan is secretary; A. B. Trow is treasurer, and E. S. Williamson is manager.



Construction view of separating plant

Widow to Operate Quarry

MRS. JOHN C. STAHL, of Middleburg, Penn., plans to conduct the stone quarry business established by her late husband, who was fatally injured while at work at the quarry at Paxtonville recently. Charles Bowersox, a brother of Mrs. Stahl, will continue as foreman of operations. — *Lewisburgh* (Penn.) *Journal.*

Effect of Water-Gas Tar on the Strength and Alkali Resistance of Concrete

IN PREVIOUS investigations carried on by the Bureau of Public Roads with tar and paraffin as a means for protecting concrete against alkali attack, no quantitative data were obtained regarding the effect of the tar treatment on the strength of the concrete or its resistance to the action of sulphate solutions under severe service conditions.

It was planned at the outset of the investigation reported herein to carry out strength tests simultaneously on treated and untreated specimens stored out of doors in tap water at Arlington Farm, Va., and in the sulphate water of Medicine Lake, S. D. It was found, however, that many of the lake specimens were so severely attacked after a comparatively short period that the relative degree of protection offered by the various tar treatments could best be obtained by recording the conditions of the samples from year to year.

Results of these tests to date have been summarized by Dr. E. C. E. Lord, petrographer, U. S. Bureau of Public Roads, and were published in the June issue of *Public Roads.* Conclusions drawn from these are:

(1) The compressive strength of concrete cured for varying periods in damp and dry air and treated with 4 or more coats of water-gas tar and 1 coat of coal tar is somewhat lowered during early stages of hardening under water, but this loss is ultimately almost fully regained.

(2) During the early stages the strength decreases rather uniformly with increasing quantities of tar absorbed, but when ultimate strength is attained the effect of the tar is negligible.

(3) The protection against alkali action afforded concrete by the tar treatment is influenced by the cement content, method of curing and consistency of mix, being most effective in rich mixes of medium consistency cured for a minimum length of time in dry air.

(4) Concrete of wet consistency is less tar-absorptive and offers lower resistance to alkali attack than concrete of medium consistency cured in the same manner, although no positive relation is shown to exist between the amount of tar absorbed and the resistance to alkali attack.

(5) The protection to concrete afforded by the water-gas tar treatment, under the severe conditions imposed in this investigation, was increased only to a limited extent by the application of a nonpenetrable surface coat of coal tar.

(6) Concrete of high cement content, cured for a limited period in dry air and treated with water-gas tar, is capable of offering appreciable resistance to alkali attack under the conditions imposed in the foregoing investigation.

Economics of the Nonmetallic Mineral Industries*

Part VII—Cost of Sales

By Raymond B. Ladoo
Manager of the Industrial Commodities Department, United States Gypsum Co.

A LARGE PART of the ultimate cost to the consumer of his purchases is the cost of moving the product to its final destination and the cost of selling. Often the cost of selling is more than the production cost. Selling cost includes all direct and indirect advertising, sales salaries and expenses, commissions, general sales overhead and so on. In many companies production costs have been more closely analyzed and reduced by more efficient operation than have sales costs. High selling costs have often been thought inevitable. Today, when the whole problem of distribution is regarded as being the key to our economic structure, selling costs are properly being more carefully studied. Some of the items of high sales costs in the past are, fortunately, today either prohibited by law or not countenanced by present day business ethics. Companies with the highest standards today will not permit either the giving or the taking of bribes or expensive presents by their selling or purchasing organizations, and while the cruder forms of commercial bribery are not today in general favor, other similar abuses continue in many industries. "Entertainment" still forms a large item of sales cost in many companies. That excessive "entertainment" of customers and prospective customers is not necessary for successful selling has been demonstrated by some of the largest and most profitable companies. Yet others in the same industries continue to load down their sales costs with such items.

Editor's Note

THE PART SALES COST plays in operating profits is a most important factor. Mr. Ladoo says that much progress has been made in reducing production costs by analyzing and improving methods based on careful study of production costs. Less attention has been given actual selling costs by many organizations. The importance of more careful consideration of this matter is shown, and factors entering into these costs are pointed out. Ideas are given of methods of obtaining such cost reduction.—The Editor.

Ways to Reduce Sales

Sales costs may be reduced in ways other than by cutting down on direct sales expense. By careful planning and routing of salesmen, more calls may be made per man per day. Proper use of the long distance telephone as an aid to salesmen increases sales per dollar of sales cost. Perhaps the most effective means of reducing costs is the adding of other commodities to the salesmen's lines. If a salesman is covering a certain type of trade with only one commodity to sell, a call is largely wasted when he fails to sell that one commodity, but if he has five or ten or twenty commodities, he has a far better chance to make each call pay. If a salesman is selling talc as a paper filler he calls on many companies who use both talc and clay or who use only clay. If he cannot sell such companies his talc, he might be able to sell them clay. His own company need not necessarily go into the production of clay, but perhaps it could arrange to handle clay on a jobbing basis.

If a company not only has several commodities to sell, but through warehousing at suitable points, can also offer mixed car service to smaller buyers, another very strong selling force is added.

Factors Affecting Sales Cost

The direct cost of selling depends on volume of sales per man, number of products handled, size of salesmen's territories, number of actual and possible calls per day, closeness and cost of supervision, type of products to be sold, whether products are sold in small lots to retailers or consumers or in large lots to wholesalers and large dealers.

Methods and costs of selling need very careful and detailed study, but, before the efficiency of selling may be determined, standards of performance must be set up. A market survey will show how much total business is available in a given area; how many salesmen are needed to cover that area thoroughly; how many salesmen the present or probable sales will justify; most efficient routing of salesmen and so on.

Sales costs vary enormously within the same and comparable industries. For example, of two companies manufacturing and selling almost identical products, carrying a manufacturing cost of about $15.00 per unit, one has a sales cost of $2.50 and the other a cost of $15.00. This extreme variation is due in part to relative efficiency of sales methods and in part to the fact that one company sells a large line of products while the other has but two or three commodities to sell. The lack of sales efficiency, of course, is the result of poor management and incompetent or poorly trained salesmen, which again is a fault of management. The efficient company lays out its sales territories properly; it routes its salesmen or teaches them to route themselves to best advantage; it has proper systems of supervision, reports, records, quotas and so on, so that each salesman's performance can be followed daily.

No general rules or standards applicable to all industries may be laid down and this subject has been covered many times before in books and magazines, but it is sufficient to point out here how vastly important the subject is. What many producers do not realize is that costs of selling vary so widely within the same industry and that high sales costs, which often mean ultimate disaster, can usually be lowered by careful study and proper methods.

(*To be continued*)

Proceedings of the American Concrete Institute

THE Proceedings of the American Concrete Institute, Volume 27, 1931, has been issued.

This publication contains a directory of the Institute in both alphabetical and geographic order, an index to the proceedings, and an index to Institute abstracts.

Publish Technical Papers on Sand and Gravel

TWO reprints of articles from the April, 1931, issue of the *National Sand and Gravel Bulletin* have recently been issued by the National Sand and Gravel Association, Inc., Washington, D. C. Circular 9, "Utilization of Finer Sizes of Gravel in Concrete Highway Construction," is by Bert Myers, engineer of materials and tests, Iowa State Highway Commission, and "Deleterious Substances in Concrete Aggregates" is by F. C. Lang, engineer of tests and inspection, Minnesota Highway Department.

Freezing Tests on Mortar and Concrete

Abstract and Review

By Edmund Shaw
Contributing Editor, Rock Products

"THERE IS NO more important problem confronting the producer of aggregate today than that of having a proper soundness test developed that will truly indicate the soundness of his material. Very rapidly some form of soundness test is being written into specifications for aggregates." For these reasons, A. T. Goldbeck, director of engineering, National Crushed Stone Association, has carried on research in soundness of aggregates and mortars and concretes for some time past in the association's laboratory. Earlier work had to do with both the sodium sulphate test and the accelerated freezing and thawing test. In the April issue of the *Crushed Stone Journal* he gives the results of freezing and thawing mortars and concretes and draws some very interesting conclusions from them.

As he notes in the introduction, when a concrete structure disintegrates it is hard to say whether the cement, the fine aggregate or the coarse aggregate might have been at fault. If the rock exhibits some unsoundness, what may its unsoundness be before it is unsuitable for use as coarse aggregate? Do we need as severe a test in the South as we do in the North, where frost action is severe? These and many other questions remain to be solved.

Water-Cement Ratio Most Important Factor

It is known that concrete with a low water ratio is more durable because there are less water voids, but how high a water-cement ratio is safe? In these tests water-cement ratios from 0.63 to 0.98 were tried. Methods of curing were varied. The first series was given 14 days in moist air, 12 days in dry air, 1 day in oven and 1 day in water. The second series had 14 days in moist air and 13 days in dry air and 1 day in water. The third series had 28 days in moist air.

The neat cement mortar specimens cracked in the oven and disintegrated after 6 cycles of freezing and thawing. All the specimens completely disintegrated after 10 cycles. The mortars with sand failed by a continuous surface disintegration. They were carried on through 50 cycles, and the photographs with the article show the disintegration after 35 cycles. From these it is plain that the rich mixes disintegrated more than the lean and that the wet mixes disintegrated much worse than the dry mixes.

The free water (that which did not combine with the cement in setting and hardening) was figured by dividing the weight immediately after molding by the oven dry weight. A table of the free water contents shows that in the neat cement specimens it ran from 21.5 to 32.6%. With the 1:3 mortars it ran from 7.8 to 11.3%, and these disintegrated least. The other mixes were in between these. The paper concludes that "free water content controls the durability of mortar, certainly within the limits of this investigation."

This disintegration of rich mortars does not agree with the results in service which generally show rich mortars to be the more durable. The paper notes this and says the reason is that in structures rich mortars generally have the lowest water-cement ratio and hence less free water. In these tests (made to the same water-cement ratio and hence *not* to the same consistency) the neat specimens were almost soupy.

Series II and III were undertaken to approximate more nearly the conditions of structures in service. In Series II it was found that the specimens disintegrated "in about the order of their water-cement ratios, the higher water-cement ratios being most readily attacked." Also that: "In a general way the resistance to disintegration has some relation to the free water content, although this relation does not seem to be exact."

In Series III the specimens (all cured 28 days in moist air) disintegrated in 35 cycles, as did the others, and these with water-cement ratios of 0.91 and 0.98 were rather the worst of the lot. Richness of mortar does not seem to have any particular effect on durability when the water-ratios are about alike.

Unsound Mortar from Sound Sand

An outstanding feature of these tests is that while the mortars disintegrated quite readily (in 35 cycles) the Potomac river sand of which they were made is very resistant to the sodium sulphate test and to freezing and thawing. It is therefore possible to have unsound mortar from sound sand.

Five glacial gravels and five sands were tested. All the sands were found to be questionable or definitely unsound. They were tested in a 1:2 mix, cured as in Series II, and found to be sound after 50 cycles of freezing and thawing. Even after 70 cycles the mortars with these unsound sands "were incomparably better than those made with Potomac river sand, supposed to be sound." If these tests are indicative, they show that durability of sand is not necessarily an indication of the durability of the mortar, the paper states.

Soundness of Coarse Aggregate

An interesting case was that of a diagnosis of concrete which failed at the end of one year. The coarse aggregate was cleaned and both it and the mortar were subjected to alternations of freezing and thawing. With seven alternations the stone remained intact but the mortar utterly disintegrated, showing the unsoundness of the stone could not be blamed.

The paper concludes that: Sound portland cement with water alone in water-ratios of 0.63 to 0.98 is not always sound when subjected to freezing. It is possible for rich mortars to fail and lean mortars to possess a good degree of durability. Also the reverse of this is true. Much depends on the amount of free water in the mixture. Tests indicate that it is possible to have an unsound mortar with a "sound" sand and a sound mortar with an "unsound" sand, each having the same water-cement ratio. Coarse aggregate, even though in some cases unsound, does not necessarily make for unsoundness in concrete. The unsound stone tested did not crack the concrete nor did the stone leave the concrete or cause pitting. Only after the mortar had failed did the stone fail by continuous chipping. The cementing medium seems to be a most important element in the durability of concrete. It is highly important that the water-cement ratio be kept low.

Tennessee's Highway Program Is Abandoned

THERE will probably be no more highway work in Tennessee done this year, except that which is financed by the emergency federal aid appropriations, R. H. Baker, commissioner of highways, announced following the failure of the recent legislature to authorize a $10,000,000 road bond issue. It will be necessary to discharge all construction forces, reduce the maintenance organization and turn back for county maintenance a number of sections of road not yet incorporated in the state system, Mr. Baker announced.—*The Constructor.*

Large Mineral Exhibit at Montana State Fair

THROUGH the concerted efforts of the Montana School of Mines, the bureau of mines and others, and with the assistance of the larger mining corporations and mining men of the state, the mines and mining exhibit at the Montana state fair, August 17, was the largest and most interesting display of the character ever shown in Montana.

Approximately 2500 specimens of minerals and ores, both metallic and nonmetallic, were on exhibition, including every known mineral from coal to the most beautiful of precious stones.

Besides the usual collection of lead, copper, zinc, gold and other ores, some new white crystals of barite and some handsome specimens of lead-zinc-arsenic ores from Utah; lead ores with crystals of lead molybdate; a specimen of pure arsenic; a specimen of strontium sulphate, a mineral from which railroad flares and fireworks are made; an extensive collection of chalcedony and agates; vanadium crystals, a mineral used in hardening steel for automobile axles, and tin ore from Cornwall were shown.

Lava from the volcano of Kilauea, near Honolulu, was shown with specimens of "Pele's air," a mineral wood produced by volcanic action.

George B. Conway also prepared an exhibit of nonmetallic minerals, of which there are many in the state of large value. These include vermiculite (zonolite), mica, fluorite, fuller's earth, bentonite, calcite products, gypsum and sulphur.

Aside from the extensive showing of ores and minerals, considerable space was devoted to the display of miniature replicas of mining and ore reducing machinery, to mine workings and other features of mining interest.—*Helena* (Mont.) *Independent.*

Nevada Feldspar Operation Started

THREE 60-ton carloads of feldspar have been shipped from the property of Nate Kearns and sons, near Peavine, Nev., siding 18 mi. north of Reno. The property is 10 mi. from the railroad. Shipments are consigned to the American Development Co. at Berkeley, Calif., which is paying $10.25 per ton for feldspar f.o.b. Berkeley. Railroad freight from Peavine to Berkeley is $2.30 per ton, leaving $7.95 to cover mining and trucking charges. At present ore is extracted entirely by surface quarrying from a deposit 1500 ft. long and 4 to 8 ft. wide. It has been explored to a depth of only 15 ft. In addition to feldspar, analyses of the material made by the Mackay School of Mines have indicated the presence in the deposit of rare metallic ores.

So far as can be determined, this is the first commercial exploitation of a feldspar deposit in Nevada.

Investigate Asphalt Purchases in Milwaukee

A GENERAL INVESTIGATION of all the Milwaukee, Wis., park board's 1931 purchases, especially those of Kyrock, a paving mixture, has been undertaken by the executive committee of the board of purchases at the instance of Mayor Hoan, it was revealed recently. A record of all purchases this year has been demanded.

Kyrock costs $18 a ton, freight paid to Milwaukee from Bowling Green, Ky., where it is quarried, according to O. W. Spidel, city forester and superintendent of parks. Mr. Spidel admits that much of it has been purchased without competitive bidding. R. W. Gamble, city superintendent of construction, said that asphalt of similar quality, prepared in the municipal asphalt plants, costs $5 a ton delivered.

The first intimation of the controversy came at a meeting of the park board, when Commissioner Handley demanded a report from Mr. Spidel on the amount of Kyrock purchased this year.

"I want to know how much of this material we have bought so far, how much more is contracted for, where it has been placed and why it was all bought from one firm," Mr. Handley said.

"From the way we have been buying Kyrock it is rapidly becoming a monopoly," Mr. Handley asserted.

Mr. Spidel later reported that the board has bought 45 carloads at a cost of $720 each, freight paid to Milwaukee, and that more has been ordered for walks in Kern park and tennis courts in McKinley park.

Ira Bickhart, Milwaukee representative, said that no higher price than $15.40 a ton, freight paid, had been charged for his product this year. Mr. Spidel's $18 figure is an error, he claimed.

"We have been using Kyrock for experimental purposes only," Mr. Spidel asserted. "Including labor costs, costs of foundation materials, Kyrock surfacing material and transportation charges from cars to the jobs, we have laid walks and drives at a cost of $1.35 a sq. yd."

His records, he said, indicate that the purchases this year have totaled more than 2000 tons.

The Milwaukee school board approved the purchase of Kyrock when it awarded an $11,680 contract to the Kroening Construction Co. for "rock asphalt surfacing" the Humboldt park school playground. Secretary Harbach of the school board said that "rock asphalt" specified was Kyrock.

But in this instance, as in three other playground surfacing contracts awarded, there were three options on materials specified. Kyrock was low only on the Humboldt Avenue job, Mr. Harbach said. Emulsified asphalt was low on two and emulsified tar and asphalt was low on one, he said.—*Milwaukee* (Wis.) *Journal.*

Zonolite Company Plans Expansion

AT THE annual stockholders' meeting held in the offices of the Zonolite Co. at Libby, Mont., July 28, C. L. Emmons, M. F. Gay, A. C. Johnson, B. D. White and E. N. Alley were elected directors for the ensuing year, and the office of chairman of the board of directors was created.

The proposed increase in capital of 100,000 shares of a par value of $1 each was authorized by the unanimous vote of all stock represented at the meeting.

While the entire increase had been underwritten by the Dominion Stucco Co., Ltd., of St. Boniface, Manitoba, a subsidiary of Gypsum, Lime and Alabastine, Canada, Ltd., the representative of that company waived this arrangement insofar as the old stockholders are concerned. It was therefore agreed on a vote of the meeting that the present stockholders should be given the right to subscribe to the new issue in proportion to their present stock ownership in the company, which would amount to 25% of their present holdings. The time in which the stockholders might avail themselves of this option was set at August 28.

The Dominion Stucco Co., Ltd., has agreed to take all of the increase in capital not subscribed by the present stockholders. They have further agreed to advance the sum of $25,000 immediately on the purchase price of the stock and the balance whenever the board of directors of the Zonolite Co. decide to install the gravity aerial tram.

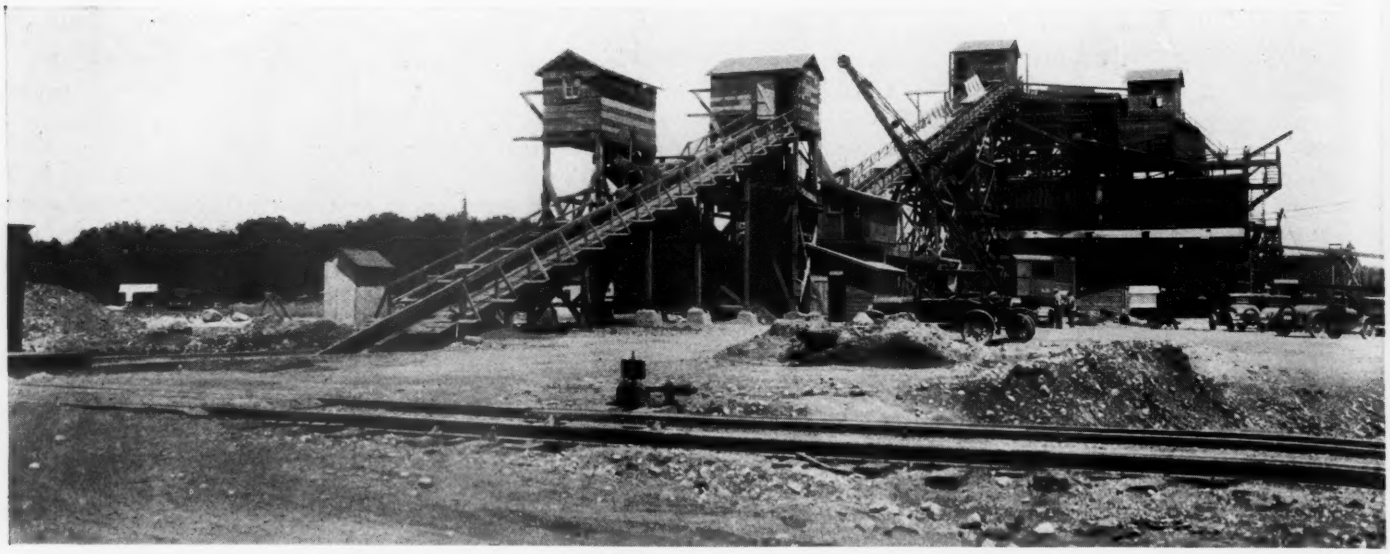
The board of directors organized at their meeting by electing C. L. Emmons chairman of the board; E. N. Alley, president; B. D. White, vice-president; M. F. Gay, secretary-treasurer, and appointed W. M. Stevens, assistant secretary.

B. D. White was appointed manager of the eastern development and instructed to proceed forthwith in the selection of a suitable site and the building of a processing plant in Chicago or vicinity. Mr. White was further authorized to secure warehouse facilities and make all arrangements necessary to put the plant on production, and thereafter manage the affairs of the eastern plant in the production and marketing of Zonolite.

Minerals in Eastern Tennessee

AT MASCOT, Tenn., only a short distance outside the city limits of Knoxville, is the center of the zinc mining operations in Tennessee. The American Limestone Co. operates an important plant at Mascot in conjunction with the zinc plant.

In no other section of equal area in the United States is there found such a wide variety of minerals in commercial quantities as are found within 100 mi. of Knoxville. Among these resources are included: coal, iron, zinc, copper, marble, limestone, manganese, barytes, bauxite, feldspar, fluorspar, silica, kaolin, lead, gold and clays.



General view of plant, with track hopper and crushing plant in foreground

Extra Measures Insure Clean Gravel

Concrete Materials Corp. Uses Double Washing and Hand Picking at Wallingford, Iowa, Plant

THE NEW PLANT of the Concrete Materials Corp. at Wallingford, Ia., which was put into operation in April, is probably the largest sand and gravel plant built in Iowa so far this year. Designed for an output of 60 cars per day it is expected to turn out around 6000 cars of sand and gravel during the present season.

The plant is located in Emmet county in the northern part of the state and is being used to supply most of the aggregates for the company's highway contracts in northern Iowa. It is served by the Rock Island railroad and is situated along the Des Moines river.

The deposit, for this operation, like most of Iowa's sand and gravel deposits, is of glacial origin and has a high percentage of sand, approximately 25% gravel and 75% sand.

Also, like most of these deposits, the gravel contains impurities and foreign materials in the way of shale, off-colored "iron-oxide" pieces and some pieces with a core of clay. These are difficult to remove except by hand sorting or picking and even then the soft cored pieces cannot always be located unless they have been broken in the crushing process.

Hence, the coarser gravels are handled in such a way that the "iron-oxide" and clay-centered pieces may be picked out by hand. The shale is for the most part removed by log washers after the coarser gravel has been washed and sized in the screens. Very little trouble is experienced with the smaller gravel sizes.

On account of these impurities the output at first was less than anticipated but this difficulty was overcome by the installation of additional screening capacity early in June.

Dragline Excavators Used

Excavating is done with a 2-yd. Monighan walking dragline machine, electric-motor

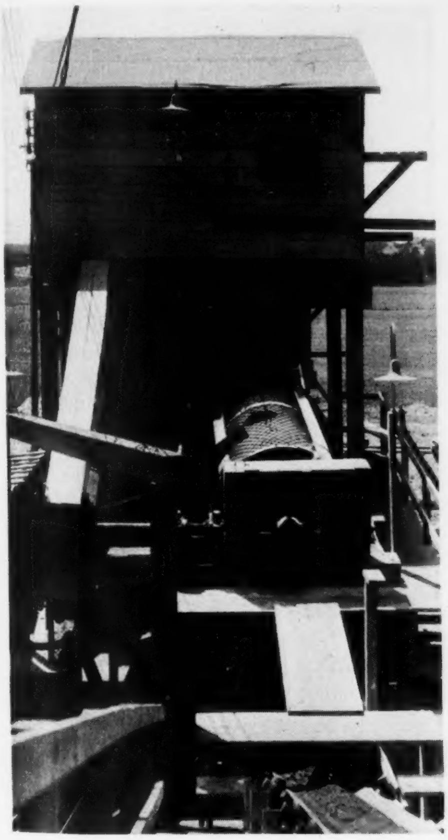
Electric dragline for loading at pit

Dragline for backcasting the strippings

driven, and a 1½-yd. P and H dragline excavator, which load to standard gage hopper bottom cars. The overburden, consisting of from one to three feet of loam, is removed and cast back into the worked-out section of the pit by the machines which do the excavating. Most of this stripping is done while the loaded cars are making the trip to and from the dump hopper. A second P and H excavator is equipped for both clamshell and dragline and may be used for stockpiling or as a relay excavator.

The cars are moved to the plant by 12-ton Plymouth gasoline locomotives and a 22-ton Davenport steam locomotive. A second 12-ton Plymouth locomotive is used for spotting cars at the bins and a 22-ton Davenport steam locomotive hauls the loaded cars to the railroad siding about three-quarters of a mile away.

New vibrating screen recently installed to give sufficient sizing capacity to synchronize with other operations



The scalping screen

The loaded cars from the pit are dumped to a track hopper from which the raw material is carried on a 24-in. inclined belt conveyor to a scalping screen and crusher. This is a 4-ft. by 12-ft. Toepfer revolving screen with 1⅞-in. round holes from which the oversize falls to two gyratory crushers, a 13-in. and an 8-in. Superior McCully, for further reduction.

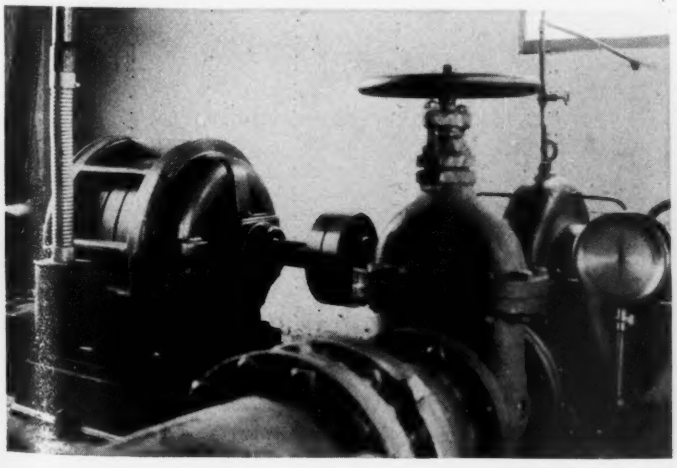
Only 1 7/8-in. Material Goes to Main Screens

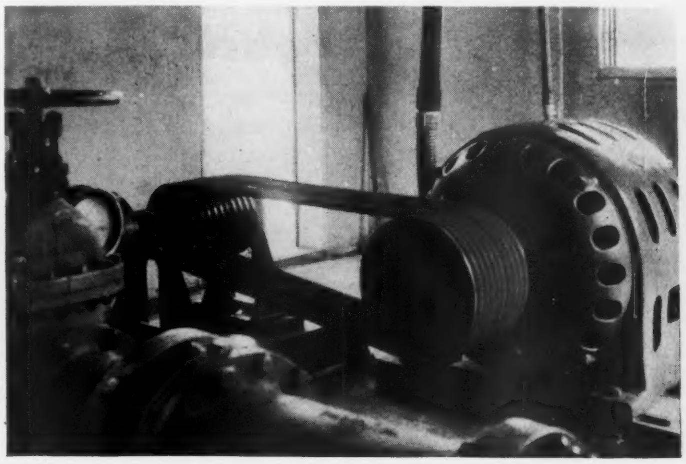
The material from the crushers is returned on an 18-in. inclined belt and mixed with the gravel going to the scalping screen so that all the gravel is reduced to 1⅞-in. size before going up to the main screens. All the minus 1⅞-in. material from the scalping screen falls to a second 24-in. inclined belt conveyor and is carried up to the top of the sizing and washing plant.

As originally designed the sizing was done in a revolving screen but this proved to be a sort of "bottle neck" for the whole operation so that the screening capacity at this point was increased by addition of a vibrating screen alongside. A 4-ft. by 10-ft. double deck Niagara screen with ½-in. mesh wire cloth on the upper deck and $\frac{3}{16}$-in. mesh cloth on the lower deck, was added.

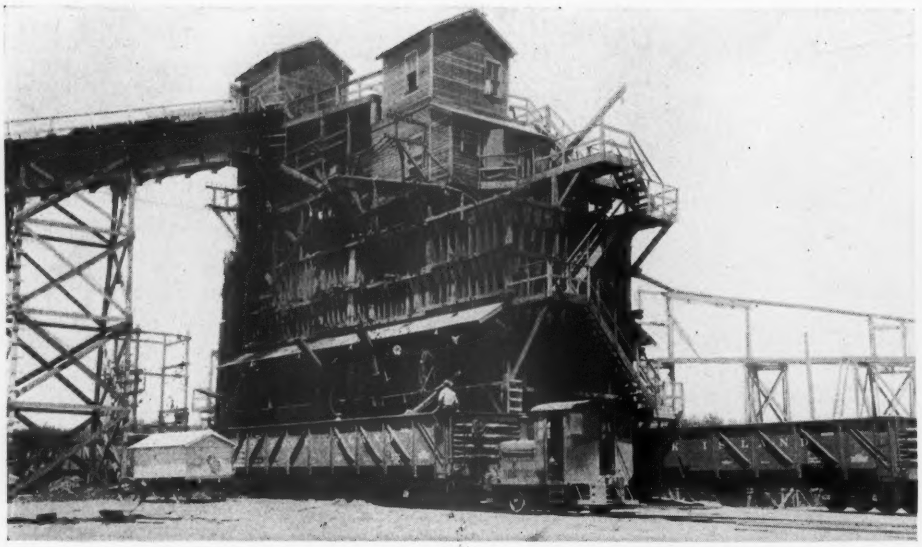
The revolving screen has an inner barrel 6 ft. in diam. by 24 ft. long consisting of 18 ft. of ½-in. round perforations and 6 ft. of ⅞-in. round perforations. The outer jacket is made up of 8 ft. of ½-in. by $\frac{3}{16}$-in. slotted perforations and 4 ft. of ⅜-in. round perforations. Both screens are arranged with jets for washing.

The material passing over the outer jacket of the revolving screen falls to a 2-ft. by





Two 8-in. pumps for supplying water to the washer



Cars are moved back and forth in front of loading bins to prevent segregation and are subject to constant inspection

4-ft. Simplicity vibrating screen where any sand which has carried over is removed before the material goes to the bins below.

Double Washing in Sand Cones

The fines passing through this jacket are flumed to a 72-in. Link-Belt sand settling cone from which the sand is discharged to a second sand settling cone of the same size and make. Fresh water is added to flume the sand into the second cone. This feature of the operation is unusual and in this case was necessary in order to get rid of the silt and other impurities. The overflow from both cones goes to a sump and is pumped to the waste pile by a 6-in. centrifugal pump driven by a 75-hp. Westinghouse motor through a Link-Belt silent chain drive. The material from the Niagara screen is washed in a similar manner.

The clean concrete sand from the lower cone falls to bins below.

Log Washers and Picking Tables Used

The coarser gravel from the inner barrel falls to three Eagle log washers, two double and one single, and thence to picking tables. The picking tables are simply inclined aprons on chutes between the washers and the bins. They are about 4 ft. wide and are set at such an angle that the material will flow over them in a slow stream, allowing the inferior pieces to be picked out.

In this way, and also by having two or three men stationed in the car as it is being loaded, any off-grade pieces are removed from the coarse gravels. A state inspector and two assistants maintain a rigid inspection so that the material may meet the requirements of the state specifications. Each car is carefully sampled and tested before it is shipped, and in order to carry out this work the state maintains a field laboratory equipped with test sieves, drying ovens, and other laboratory apparatus.

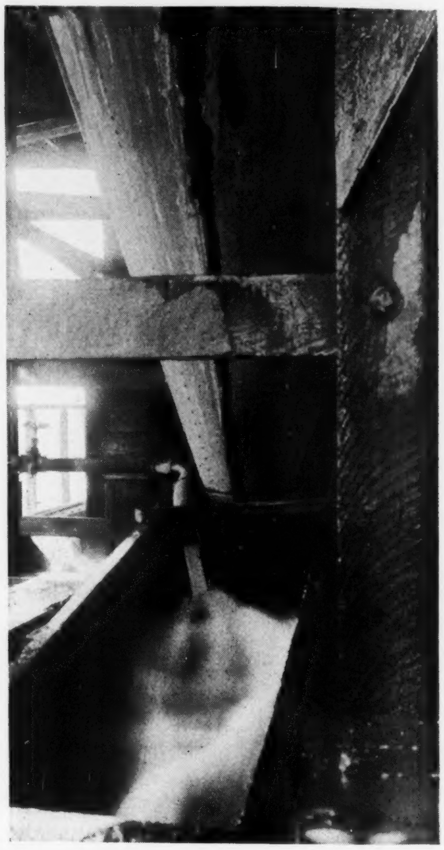
Segregation of the gravel during loading is reduced by having one of the 10-ton Plymouth locomotives move the car back and forth past the loading chute until it is completely and evenly loaded.

Water for washing is supplied by two 8-in. Fairbanks-Morse centrifugal pumps. One of these is driven by a direct-connected 75-hp. General Electric motor and the other by a 100-hp. Electric Machinery Manufacturing Co. synchronous motor through a V-belt drive.

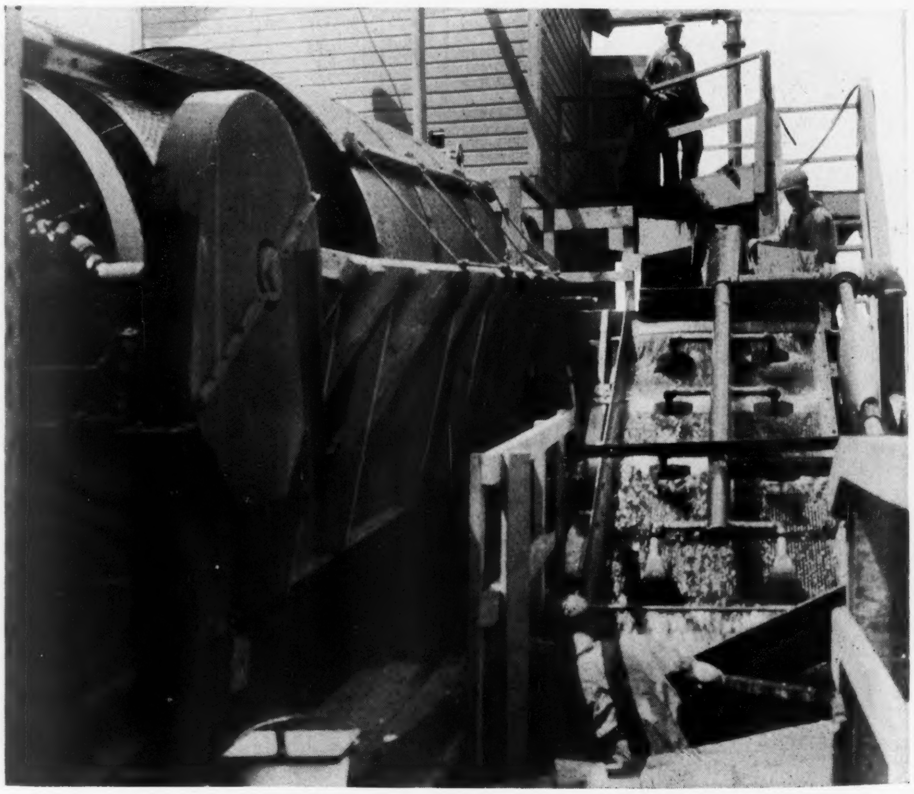
Other Plants and Personnel

In addition to this plant the company also operates sand and gravel plants at Clarksville, Eddyville, Humboldt and Waterloo, Ia., as well as a crushed stone plant at Bethany, Mo.

The main offices of the company are at Waterloo. H. D. Bellamy is president; T. E. Rust is vice-president and general manager; C. E. Oldham is secretary and treasurer. J. L. Galyean is superintendent of the Wallingford plant.



Sand cones operate in series



Rotary and vibrating screens for primary classification

Asks Injunction Against Gravel Pit Lease

THAT the Western Sand and Gravel Co. of Spring Valley, Ill., is preparing to file suit for an injunction against the city of Spring Valley, seeking to restrain the municipal government from the award of a contract for a lease on a Spring Valley gravel pit to Chicago interests, was revealed August 12 when Glenn N. Sitterly, vice-president and secretary, declared that attorneys for the company had been instructed to file proceedings in the circuit court at Princeton.

The threatened injunction proceeding is to be based on an allegation that the Spring Valley city council disregarded a bid by the Western company when it awarded a lease to the Chicagoan.

A prepared statement, issued by Mr. Sitterly recently, read:

"Spring Valley city council on August 12 granted a lease to James Casey of Chicago on tract known as City Gravel Pit.

"On October 20, 1930, former council accepted bids on this same property from Western Sand and Gravel Co., Spring Valley, and a Mr. Nelson of Grand Rapids, Mich. No definite action was ever taken by former body,

"At council meeting of August 3 a proposal was made by James Casey of Chicago to lease this tract. The matter was carried over until the meeting of August 10 for study and consideration. At meeting of August 10 a proposal was also submitted by Western Sand and Gravel Co.. They proposed to lease the tract for a period of five years, starting September 1, 1931, property to be used as site for trackage facilities and no existing sand or gravel to be removed. The Spring Valley company offered to pay the city a sum of $200 per year for the five years, and also give the city 1000 cu. yd. of prepared gravel for street surfacing per year, material to be delivered to the city trucks from overhead bin at its plant at Spring Valley. It was explained that upon the basis of the present selling price this amount of material would amount to approximately $750 per year.

"The Chicago party offered to lease the tract for one year, from March 1, 1932, with right of extension for four additional years, and payment of $25 the first year, $100 the second year and $125 the three remaining years and also to give the city 1000 cu. yd. of gravel if the option to extend the lease was exercised and plant was constructed.

"The council granted the lease of the Chicago party and placed the offer of the local company on file. The Western Sand and Gravel Co. owns gravel land adjoining the city property and does not believe it was fairly dealt with in the matter. This company will institute injunction proceedings before the circuit court of Bureau county in an attempt to restrain the city officials in the grant of this lease."—*Peru* (Ill.) *Herald.*

Starts Sand and Gravel Operation in Iowa

THE Lillie Coal Co., Dubuque, Ia., will go into the sand, gravel and cement business, according to an announcement made by Harvey Lillie, proprietor. The firm will continue operation under the same name pending changes that may include other lines.

The company has secured 35 acres 5 mi. north of Dubuque, with a rail siding on the Milwaukee railroad. It is also within trucking distance of the city.

The deposit is Mississippi river run material with very little stripping necessary to open it up for commercial use. A Sauerman "Crescent" unit is to be used at the pit with a 40 yd. capacity bin, screen equipped, for car and truck loadings. Any percentage of sand and gravel can be furnished, as can sand and gravel alone. Washing is possible, the Maquoketa river flowing nearby.

At the main office and coal yards there is to be a 30 yd. sand and gravel bin for city and small job deliveries. A bucket elevator will handle material to the bin from either truck or cars. At present the capacity of the plant is 300 yd. a day.

In commenting on the new departure Mr. Lillie stated that the remainder of the 1931 season would be devoted to experimenting on his part and that the spring of 1932 would mark considerable building and installation of equipment best suited to the acreage available. The firm is also empowered by United States engineers to dredge sand and gravel in the Mississippi river.

Open Gravel Pits in Wisconsin

THE Wissota Sand and Gravel Co. of Eau Claire, Wis., is engaging extensively in the sand and gravel business in that section of the state. Leases have been taken on several hundred acres of land at Haugen and the company has also taken over the former Soo Line gravel pit near Bruce. The company has been supplying thousands of tons of washed sand and gravel to contractors engaged in paving operations there.

Leases running over a period of five years have been taken by the company on the property of several owners in and near to the village of Haugen.—*Rice Lake* (Wis.) *Chronotype.*

New Sand and Gravel Plant in Erie, Penn.

THE Pittsburgh Foundry and Construction Co. has been awarded a contract by the Erie Sand and Gravel Co. for a new sand and gravel plant, which is to be built at the foot of Sassafras street in Erie, Penn. The work is to cost in the neighborhood of $11,000 it is revealed in a permit issued August 10 by the city building inspection department. Work is to get under way immediately.—*Erie* (Penn.) *Dispatch-Herald.*

Urges Cut in County Gravel Road Levy

INDICATIONS that the gravel road levy for next year would be reduced from the 13c. rate fixed last year were seen at Marion, Ind., as county commissioners and the highway superintendent, Kenneth Sparks, prepared to file the budget with the county auditor.

While the commissioners and superintendent had not yet agreed on the rate for the ensuing year, it was believed that the rate would be reduced possibly to 10c. or 11c. Mr. Sparks and Pearl Hodson, president of the board of commissioners, are said to have favored the reduction in rate while Frank Bradford and John Himelick, other board members, favored the retention of the present rate or possibly an increase of 1c.

The highway department now has approximately 900 mi. of roads in the county system. During the last year two of the important highways were taken over by the state highway department. Elimination of the cost of maintaining two major roads and increased revenue from the gas tax fund will enable the department to continue the maintenance of the 900 mi. of highway without an increase in rate, Messrs. Sparks and Hodson have pointed out.

Major costs of the dust proof roads which now connect each of the principal cities and towns in the county have been paid and maintenance costs will decrease each year, Mr. Sparks said.

Arthur Green, county auditor, is also said to support Messrs. Bradford and Himelick in their stand for retention of the present levy or possibly a slight increase. Mounting deficit in the department has been assigned as the reason for keeping the present or possibly a higher levy.—*Marion* (Ind.) *Chronicle.*

Seize Company Employes for Gravel Dredging

WILLIAM J. LEACH, resident superintendent of the O'Brien Bros. Sand and Gravel Co. of New York City, and Howard Page, engineer of a steam excavating shovel in the employ of the O'Brien Bros. company, were arrested recently by Chief of Police Jensen of the incorporated village of Belle Terre, charged with violating a village ordinance prohibiting gravel dredging or mining in the village. Leach and Page were arraigned before Police Judge Bayard Peck, who released Leach in $1000 and Page in $250 bail, pending a hearing before him.

These arrests followed a lull of six months in a fight between the residents of Belle Terre and the gravel companies. At that time, Leach was arrested by the village officials when he started erecting workmen's shanties and a gravel screening device on the property of the O'Brien Bros. The arrests halted the employment of about 75 workmen.—*New York* (N. Y.) *Times.*

Approximate Clay Analysis

By L. R. Davies-Graham

Chief Chemist, Goliath Portland Cement Co., Ltd., Railton, Tasmania

IT MUST NOT BE THOUGHT that this method is offered as a substitute for the usual lengthy process, but it has been found useful in this plant and is offered to others for what it may be worth. We use limestone overburden as an admixture with the limestone, but this overburden is of a variable nature chemically, though all very similar when examined visually.

So far as possible a chemical check is kept on the overburden in place, so that we know whether any particular clay is suitable or otherwise. As this supervision requires a great number of tests, and at times it is impossible to wait for the usual clay analysis, it was desirable that a simpler and quicker procedure should be adopted.

All overburden clay has approximately the same CaO and MgO content, and is free from alkali, so that for all routine purposes Fe_2O_3, Al_2O_3 and SiO_2 contents are the essentials. The first effort was to volumetrically determine Fe_2O_3 (by bichromate) and Al_2O_3 (by uranium acetate), SiO_2 being estimated by difference. It was still necessary to fuse the clay, and the time required for an analysis was still too long.

We then tried treating the clay with hydrofluoric acid and a few drops of sulphuric acid. On heating, the silica was driven off, and the R_2O_3 plus CaO and MgO weighed as such. The ground clay is placed in a platinum crucible and about 7 cu. cm. of hydrofluoric acid and 2 to 3 drops of concentrated sulphuric acid added. The crucible is gently warmed and the acids allowed to evaporate. When dry, a further quantity of HF and H_2SO_4 are added and the warming and evaporating process repeated.

The crucible and contents are then heated to red heat for about 20 minutes, and then weighed. It is desirable, of course, to repeat the HF and red heat treatment to constant weight, but we have found that a double treatment with hydrofluoric acid, and 20 minutes of red heat removes all silica and converts the iron and aluminum to oxides.

The loss after treatment represents SiO_2 and loss on ignition. While this combined figure is being determined, a separate sample is put under way for determining the loss on ignition as this saves valuable time. The residue remaining in the crucible is R_2O_3 less 1% for CaO and 1% for magnesia. This is explained by the following figures:

Weight of crucible + sample	= 22.9806
Weight of crucible alone	= 21.9806
Weight of sample	= 1.0000
Then R_2O_3 + MgO + CaO	= .2177
	= 21.77%
of which R_2O_3	= 19.77%
and CaO	= 1.00%
and MgO	= 1.00%
Weight after HF treatment and ignition	= 22.1983
SiO_2 + loss on ignition = (22.9806 — 22.1983)	= .7823 gm.
	= 78.23%
Loss on ignition determined separately is	= 7.03%
Silica = 78.23 — 7.03	= 71.20%

COMPARISON OF APPROXIMATE METHOD WITH ROUTINE ANALYSIS

	Method used	MgO	CaO	SiO_2	R_2O_3	Loss	Total	HF results compared to usual method SiO_2	R_2O_3
Sample No. 1	Normal	0.90	0.82	57.98	31.98	8.54	100.24		
	HF	1.00	1.00	57.42	32.04	8.54	100.00	—0.56	+0.06
Sample No. 2	Normal	0.50	0.96	69.52	20.02	9.93	101.93		
	HF	1.00	1.00	67.84	20.23	9.93	100.00	—1.68	+0.21
Sample No. 3	Normal	0.75	1.00	60.12	27.80	10.12	99.79		
	HF	1.00	1.00	57.96	29.92	10.12	100.00	—2.16	+2.12
Sample No. 4	Normal	0.80	0.80	66.98	25.48	6.14	100.20		
	HF	1.00	1.00	69.65	22.21	6.14	100.00	+2.67	—3.27
Sample No. 5	Normal	0.60	0.90	54.92	32.16	11.75	100.33		
	HF	1.00	1.00	54.87	31.38	11.75	100.00	—0.05	—0.78
Sample No. 6	Normal	0.50	0.60	66.08	25.50	5.90	98.58		
	HF	1.00	1.00	65.30	26.80	5.90	100.00	—0.78	+1.30
Sample No. 7	Normal	0.70	trace	54.76	34.90	7.87	98.23		
	HF	1.00	1.00	55.53	34.60	7.87	100.00	+0.77	—0.30

The tabulated examples taken from our analytical record give an idea of results as compared with routine analysis. There are many clays which could not be treated by this short method, but there are many others which can, and as the time required for a complete "analysis" by this method is only 3 to 3½ hr., it is worth while as an indication of the clay quality.

Report on Geology of Cleveland District

ACCORDING to a report just published by the U. S. Geological Survey, the district centering about Cleveland, Ohio, which has many natural resources, had a long and interesting history before its present remarkable economic development began.

The report of the geological origin and structure of this district, which is intended for both the student and the general reader, includes two colored maps suitable for wall use, as well as for study in office, laboratory, or field, and discusses the mineral resources that have contributed to the prosperity of the district. This publication, issued as Geological Survey Bulletin 818, is entitled "Geology and mineral resources of the Cleveland district, Ohio," and may be had for 65 cents from the Superintendent of Documents, Washington, D. C.

Japanese Cement

THE recent Engineering Congress in Japan gave opportunity to many men to observe the progress that was being made in industry among the nations of the East, and in Japan particularly. Within the lifetime of living men, Japan was essentially a land of skilled craftsmen, sustaining a large population by hand labor in agriculture and industry. Today the Japanese are using every kind of machinery in the most efficient way. In the production of cement Japan is now independent of outside aid, and is exporting and not importing.—*Contract Journal.*

Southwest Road Show and School for 1932

THE DATE set for the Seventh Annual Southwest Road Show and School, Wichita, Kan., is February 23-26.

Bigger and more elaborate plans than ever are now in progress for the coming Show and School, it is said.

Quick Method for Determing Setting Time of Hard-Wall Plaster

By A. M. Turner
Supervisor of Plaster Quality, Three Forks Portland Cement Co., Hanover, Mont.

THE FACT that it is usually necessary to wait from 5 to 14 hours to determine the setting time of retarded plaster is often annoying and sometimes the results from the delay are serious.

The usual practice is to mix the plaster with sand, mix with water in a glass tumbler or porcelain cup or bowl, and remove the sample and place on a glass plate. It is then put in a moisture cabinet where it will set in due time.

A practice which can be used to speed up results is to weigh the same proportions of sand and plaster as used for the moisture cabinet test. A total weight of from 300 to 400 grams is a desirable amount. The dry mixture is placed on a board, roughly 2 in. thick, 12 in. wide, and 24 in. long (smoothly planed maple is a good kind of lumber to use). A crater is then formed by rotating the handle of a 5-in. pointing trowel in the center of the mass. Next, add the desired amount of water to the basin formed, allow it to soak a few seconds and fold the dry material into the water. Mix with a trowel to uniform consistency, place the sample on a clean glass plate and allow it to set in the laboratory subject to usual atmospheric conditions.

Before dependable results can be obtained by this method it is necessary to mix a rather large number of samples on the mixing board to break it in. The board should not be cleaned with water, but instead scraped comparatively clean with the trowel. The principal reason the setting time is more rapid when using this method is because particles of set plaster are incorporated in each sample.

The first sample mixed, when starting a series of tests, should be thrown away, because the board is dry and this sample will contain more set particles of plaster than succeeding samples. Accuracy of results obtained by the board test depend largely upon the skill of the tester mixing the samples. Each mixture should be made as uniformly as possible, the same number of strokes with the trowel used for each sample and the board cleaned with the trowel an equal amount each time.

By making numerous comparisons between the setting time of the same samples tested on the board and by the moisture cabinet method it will be found that there is a definite ratio between the two. With gypsite plaster this ratio is about 1 to 2 or with some dark plasters 1 to 2½, but with the plaster made from gypsum rock the ratio usually runs about 1 to 3.

The ideal testing procedure is to make a sample for setting time by both the board test and moisture cabinet method, and in this way both speed and the maximum accuracy may be had.

Other advantages of this faster method are that the setting time by the board test approximately equals the setting time of plaster as used in practice, and when working the sample with the trowel one can make comparative observations of the working qualities of the plaster.

Crude Barite and Barium Products Industry in 1930

CRUDE BARITE mined and sold or used in the United States in 1930 decreased about 15% in quantity and 17% in value, as compared with 1929. Total sales of crude barite were 234,932 short tons, valued at $1,538,171, according to a statement by the United States Bureau of Mines, Department of Commerce, based on figures compiled from individual reports by producers. The average value per ton f.o.b. mine was $6.55: in 1929 it was $6.67. Sales of barite were made from eight states—California, Georgia, Missouri, Nevada, South Carolina, Tennessee, Virginia and Wisconsin, the same as in 1929.

Prices Well Maintained

Despite the falling off in demand, barite prices were rather well maintained during the first part of 1930, and producers in some cases obtained a higher price per ton than they did in 1929. Market quotations at the end of the year were lower than the rather high levels reached 12 months before, and compared favorably with those for the greater part of the previous year.

Lessened demand for crude barite by the manufacturers of lithopone and barium chemicals aided the decline in quotations, and the apparent slight increase in demand for crude barite by manufacturers of the ground product was not sufficient to steady prices.

The apparent stocks of domestic crude barite, which includes only those stocks held at mine or shipping point which have not entered the market, held at mines at the end of December, 1930, were 45,255 short tons, 37,852 tons of which were held in Missouri, 1568 in Georgia, 5057 in Nevada and the remainder in the other producing states.

The total quantity and value of crude barite imported for consumption in the United States in 1930 was 52,111 short tons, valued at $179,579. As compared with 1929, the figures show a decrease in quantity of 33,618 tons, or 39.2%, and of $104,857, or 36.9%, in value. There are no official records of exports of crude barite from the United States. The commodity is utilized in this country by the manufacturers of barium products and chemicals, and exported by them in manufactured form.

Steady Consumption

The consumption of crude barite (both foreign and domestic) in the United States in 1930, as reported by the manufacturers of barium products and chemicals, was 334,139 short tons, as compared with 334,406 tons in 1929.

Of this quantity (334,139 tons) 53.6% was used in lithopone, 20.7% in ground barite and 25.7% in barium chemicals.

Proceedings of 1931 Conference on Highway Engineering

THE PROCEEDINGS of the 1931 conference on highway engineering, held at Ann Arbor, Mich., February 18-20, 1931, have been published as No. 70, Vol. XXXII of the University of Michigan Official Publications.

This 220-page book gives the papers, discussions and committee reports of the conference and may be obtained from the University of Michigan, Ann Arbor, Mich.

CRUDE BARITE SOLD BY PRODUCERS IN THE UNITED STATES, 1929-30

	1929			1930		
		Value			Value	
State	Short tons	Total	Per ton	Short tons	Total	Per ton
California	24,701	$ 147,762	$5.98	19,517	$ 114,310	$5.86
Georgia	94,118	546,212	5.80	41,746	230,769	5.53
Missouri	118,679	880,319	7.42	132,640	938,812	7.08
Nevada	818	6,384	7.80	2,647	19,457	7.35
Tennessee	26,140	181,725	6.95	17,006	111,981	6.58
Virginia	(*)	(*)	(*)	10,250	73,168	7.15
Other states†	12,813	88,304	....	11,126	49,674	....
	277,269	$1,850,706	$6.67	234,932	$1,538,171	$6.55

*Bureau of Mines not at liberty to publish.
†1929: South Carolina, Virginia, and Wisconsin; 1930: South Carolina and Wisconsin.

Hints and Helps for Superintendents

Unusual Pump Arrangement

A NOVEL ARRANGEMENT for raising and lowering a pump and its suction line is shown in the accompanying illustration.

Here a motor-driven, direct-connected centrifugal pump which takes water from the stream for use in washing gravel is located in the movable pump house.

Traveling pump house is moved with water level

It is mounted on a four-wheel truck which may be moved up or down on the inclined track extending down the slope into the stream, according to the amount of water flowing in the stream.

It has been found more desirable than a pontoon because of the strong current and variations in the stream and because of the large amount of refuse and drift material which would be collected by the pontoon, whereas the truck offers little obstruction and allows any debris to pass.

The house is pulled up or let down the slope by means of hand winch and block and tackle, the discharge pipe being disconnected and as many joints as necessary taken out or put in.

This arrangement is used at the Grand Prairie, Tex., plant of Gifford-Hill and Co., Inc.

Controlling Material Placement

AN UNUSUAL CHUTE arrangement has been worked out on an Ohio River digger dredge, for spouting gravel and sand to scows alongside the digger.

At the lower end of the rectangular chute is a hinged member, so constructed and mounted that the material may be deflected either to the far or near side, or the center of the barge, thereby permitting more uniform loading and entirely eliminating all hand trimming of the load.

The illustration indicates the method of mounting the hinged end member, by means of a ½-in. rod, running through the chute and movable member.

The chute is raised and lowered in the usual manner—by means of cable operating through a block and tackle.

Adjustment of the deflecting end section is accomplished by means of a wire cable fastened to the extreme outer end.

In the accompanying illustration, the upper, or far end of the hinged member is weighted slightly, to permit lowering by means of gravity.

An electric flood light is placed on the dredge immediately above the chute, permitting a constant view of the loading operation at all times.

Weighted deflecting section controls material placement in loading cars

Advertising Aggregate

THE SOUTHERN aggregate producers believe in letting the public know of what material the highway on which they are driving is built. In south Georgia many of the roads are built of limerock, a type of stone that is confined to Georgia, Florida and Alabama for the most part. This material, when first taken from the quarries, is a soft product but when placed on the road, wetted and rolled soon sets to a very compact mass. The road is then top surfaced with a suitable bituminous wearing surface.

Many of the highways in the states mentioned are built of this material and make a very satisfactory road. So, to apprise the public of this fact, the limerock producers have erected here and there throughout the state neat signs, painted in appropriate colors so that they compel attention. The

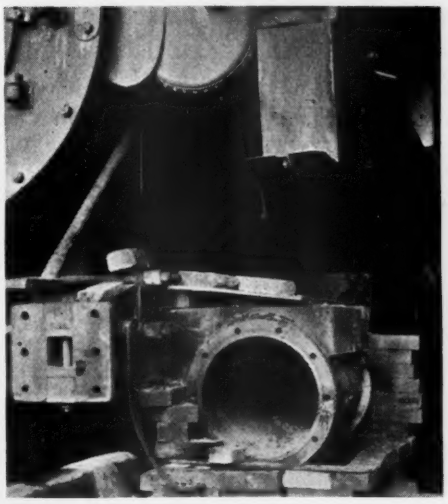
Neat sign calls attention to road type

signs are about 4 ft. in diameter, and while not large enough to obscure any view or otherwise clutter up the highway are from their artistry sufficient to attract considerable attention.

No Job for Patching

A WESTERN CEMENT COMPANY was recently faced with a difficult situation owing to the breaking of the steam cylinder on one of the industrial locomotives owned and operated by the plant. This cylinder was 17 in. in diameter with 24-in. bore and the break extended longitudinally through the outer wall of the cylinder, the overall length being about 32 in. An attempt was made by the plant men to repair the damage by means of a curved patch plate fastened by stud bolts to the cylinder wall and supplemented by rings shrunk on the cylinder flanges. The result was not satisfactory, and a better repair method was sought to effect speedy reclamation.

This plant had a welding shop, but the



Furnace built around the cylinder

welders had hesitated to try to weld this cylinder as the job was considerably larger than any that they had previously attempted. After the failure of the patch, it was evident that welding offered the only possible practical means of reclaiming the cylinder.

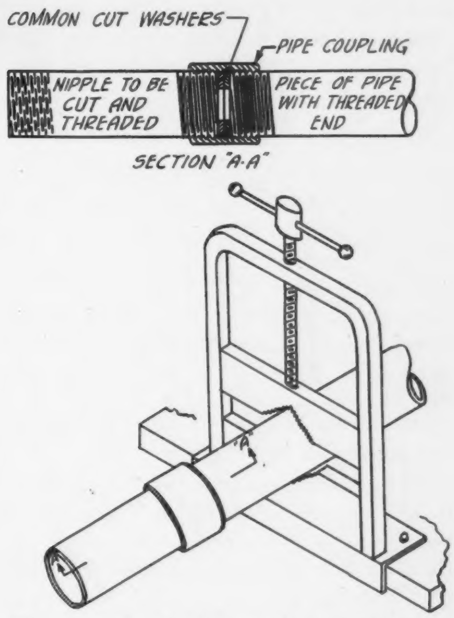
After consultation with the welding shop, it was decided to call in an oxy-acetylene service operator in order to obtain his advice as to how the cylinder should be repaired by welding.

Under the direction of the service operator the plant welders proceeded to reclaim the cylinder. The edges of the break were prepared with a 45 deg. vee and the 48 stud bolt holes shown were countersunk, as it was, of course, necessary to fill them with bronze in addition to welding the break itself. The service operator recommended that the cylinder be thoroughly preheated before welding, and accordingly a temporary fire brick furnace was constructed around the entire cylinder without dismantling it from the engine, as may be seen. Charcoal was used as the preheating fuel and when the cylinder had been brought to the proper temperature bronze-welding was started. The welding blowpipe was in continuous operation for 8½ hours, and 50 lb. of high-strength bronze rod were required to repair the break and fill in the 48 holes that were drilled in attempting the first patch on the cylinder wall.—*Oxy-Acetylene Tips.*

Simple Way of Making Short Nipples

By Chas. Labbe
Death Valley, Calif.

WHEN A SHORT NIPPLE has to be made, first thread one end of a piece of pipe of any length, then cut off to the required length. In the pipe-vise fasten an already

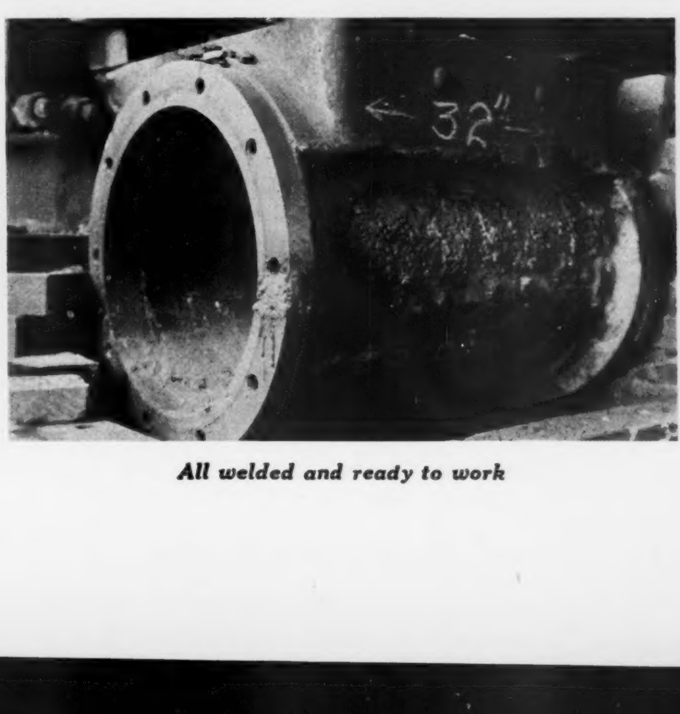


The shortest nipples can be cut this way

threaded piece of pipe with a coupling on the threaded end. Place one or two common cut washers in the coupling over the end of the pipe, next screw the threaded end of the cut short nipple so it will bear against the washer, as the nipple's end can only go as far as the washer on the end of the fastened pipe you can cut the thread to finish the nipple.

If the nipple has to be close or very short and the guiding bushing of the die interferes, use the next larger size bushing. It will just fit the coupling.

Steam cylinder ready for welding



All welded and ready to work

Britain's Biggest Cement Groups Merge into One

DETAILS of the arrangements of the Associated Portland Cement Manufacturers of England to purchase the Allied Cement Manufacturers have just been communicated to the stockholders of the latter company.

By this deal the "Red Triangle" chain will be absorbed by the "Blue Circle." Included in the assets to be acquired are the works and businesses of the following concerns: Allied Cement Manufacturers, Ltd., Ellesmere Port; Holborough Cement Co., Snodland; Greaves, Bull and Lakin, Sittingbourne; Dunstable Portland Cement Co., Dunstable; and British Standard Cement Co., Rainham. These companies constituted a group second only in strength to the "Blue Circle" chain.

The total purchase consideration is $10,125,000, plus a sum for certain manufacturing stocks and the like, and the directors consider that on these terms the deal should prove of definite advantage to the combine. As five of the companies mentioned had an aggregate paid-up capital of £4,370,472 ($21,852,360) apart from borrowing powers, the price would seem a reasonable one, allowing for overcapitalization and duplication in the group.

To finance the purchase the directors have decided to issue 500,000 £1 ordinary shares, and the ordinary shareholders are given the right to take up at par one new share for every six shares now held. These shares will rank for one-half of all dividends in respect of the current year. Arrangements have also been made to issue £150,000 ($750,000) of 5% second debenture stock and a further £180,280 ($901,400) of 5½% £1 preference shares.

On completion of the purchase a further £750,000 of 5% second debentures will be issued. In view of the recent fine record of the Associated Portland Cement combine the new shares are expected to be readily subscribed by the shareholders.

The combined domestic trade deliveries of the two groups last year equaled 70% of the entire domestic cement trade of the United Kingdom.

Canadian Cement in 1930

OUTPUT OF CEMENT during the year 1930, according to figures supplied by the Department of Mines, Ottawa, was below that of the previous year and exports were also less than in 1929. Production in 1930 was 11,032,539 bbl., valued at $17,818,451, whereas in 1929 the production was 12,284,081 bbl., valued at $19,337,235. Exports in 1930 were 198,736 bbl., valued at $212,071, and in 1929, 234,111 bbl. were exported, valued at $252,955. Portland and hydraulic or water lime 143,436 bbl., valued at $569,848, as against 55,980 bbl., valued at $189,169, in 1929.—*Contract Journal.*

Federal Trade Investigation of Cement Industry

THE LATEST REPORT of the investigation of competitive conditions in the cement industry, involving inquiry as to whether activities of trade associations, manufacturers of cement or dealers in cement, constitute violation of the anti-trust laws shows that in connection with the field work in progress, questionnaire letters have been sent to manufacturers and state highway commissions outlining certain information desired.

A schedule asking for costs and profits from cement manufacturers was also sent out by the Federal Trade Commission during the past month. This is in connection with the general study which is making inquiry into the establishment of base prices of various commodities. The first draft of several parts of the report is complete.

Rumor of Another Cement Plant for California

FROM "street talk" it is learned that there is a strong possibility of the cement deposit two miles south of Whitewater station near Palm Springs, Calif., being developed in case the bonds for the Los Angeles aqueduct are voted in the metropolitan water district on September 29.

The deposits are extensive and the quality of the limestone is said to be excellent. The deposit was filed upon more than 20 years ago, and a tunnel which is visible from the state highway shows where development work was done over a term of years. Finally a patent to the land was procured for the land by the late Marcus Pluth, who was said to have been acting for cement interests. With the land patented the annual assessment work was discontinued.

The title to the Whitewater cement deposit is said to be owned by a large cement concern. Like many great industries the cement business is very "low" at this time. In ordinary business progress the Whitewater deposit would not be developed for a number of years, but the success of the aqueduct bond election may bring developments thick and fast at Whitewater.

A reporter sounded out sentiment at Los Angeles recently regarding the aqueduct bond election and found it quite favorable to success.—*Palm Springs* (Calif.) *Desert Sun.*

Texas to Tax Cement

UNDER the Texas law the new cigaret tax became effective August 22. The new production tax on natural gas and cement and the increased tax on sulphur became effective the same date. These are laws enacted at the regular session and go into effect 90 days after adjournment of the legislature.

Report Army May Use Foreign Cement in Canal Zone

REPORTS from reliable sources that some 50,000 bbl. of foreign cement are being used in army construction projects in the Panama Canal zone have brought to light a state of affairs that is certain to receive the attention of the next Congress.

Outstanding in these revelations is the fact that the proviso in the War Department appropriation bill making it mandatory for the army to purchase American made products, within reason, is being interpreted, in some quarters at least, to mean that it does not apply to purchases made by the army quartermasters outside the continental limits of the United States.

The fact that constructing quartermasters in the foreign service posts have always had a wide latitude in the matter of specifications is no secret, but now the possibility arises that the "American made products" clause does not apply to them. A proper interpretation of the entire situation is being sought.

The 50,000 bbl. of cement in question, whether of American manufacture or not, would not be affected by the "American made products" clause which became effective July 1, last, for the reason that they were contracted for more than a year ago, at least.

At any rate the reports that the foreign cement is being used have come in the form of a warning to American manufacturers to have the ambiguous situation cleared up before it is found that the army is free to purchase its building materials wherever it pleases too late to stop further purchases for extensive building operations to come.

On the other hand, it is shown that the Navy has purchased American cement and other building materials for its gigantic building projects at Hawaii.

July Cement Operations in Texas

IN LINE with the usual seasonal tendency, production of portland cement in Texas increased from 634,000 bbl. in June to 646,000 bbl. in July; but this increase of 1.9% is rather small in comparison with the increase of 13% between these two months in the University of Texas Bureau of Business Research's index of cement production, according to the bureau.

"July production this year is 10% greater than it was during the corresponding month of 1930," the report said. "Shipments, too, increased slightly, reaching 696,000 bbl. in July, as compared with 693,000 bbl. in June, but were 1.8% smaller than in July, 1930. The usual seasonal increase is 10%.

"Although stocks of portland cement in Texas mills at the end of July were 7.3% less than in June, they are 11% greater than in July of 1930 and are the highest for any July on record."

Editorial Comment

New Research in Concrete

To judge from letters that have come to ROCK PRODUCTS recently, we are at the beginning of a new period of research in concrete. Now that the fundamentals are fairly well established research has moved on from the general to the particular, from the study of concrete itself to the study of the materials of which it is made. There are still differences of opinion as to all the factors that control strength and workability, but they are of more interest to the scholar than to the practical man. Any engineer who is familiar with the basic principles of concrete mix design can take the ordinary materials and design for strength successfully. One need not be an engineer to do this if he follows instructions published for his guidance, although the selection and combination of materials for important concrete structures is, and always will be, a job for an engineer who understands the materials and how best to combine them.

Three letters have been received recently asking for references to literature concerning the measurement of the surface of aggregates and saying that the writers are working on the effect of surfaces. It is surprising that the effect of surface characteristics has not been given more study, since it is manifestly the extent of the surface to be covered that determines how far the cement paste will go in sticking pieces of aggregate together. This was recognized years ago to some extent, as was shown by the introduction of the surface modulus. But the measurement of surface and its effect is not the simple matter that it was thought to be at that time. The more recent work of Dr. Martin in England, and of Gross and Zimmerley, of the U. S. Bureau of Mines, has established that the surface seen by the eye may be only a fraction of the actual area exposed. In some of their experiments the "interior surface," the surface exposed in cracks and pores, was found to be five and six times the apparent, or what they call the "exterior surface." Knowing this, how is one to say what surface has the most effect on the strength and durability of concrete? If only the exterior surface is covered with cement paste, the interior surface will still take water to cover itself and thus effect the water ratio. It is evident that there is opportunity for a study of surface characteristics that will have an important practical value; and it is well that investigators are taking it up.

It is the surfaces, interior and exterior, that determine the water index, or the water demand of cement and aggregates beyond the water needed for chemical combination with the cement. Little was heard of this until it was studied in a paper by Abrams, delivered about two years ago. Now it is regularly used as a factor of concrete mix design, and according to one correspondent it is a most important factor, since it aids in designing not only for strength but for workability and yield. The study of water index in connection with the study of surface should give valuable and practical results.

Chemical characteristics of aggregates and cements are now receiving the study that they deserved long ago. The work of Leavitt and Evans at the University of Maine is well known and their opinion that "the time is past when sand may be considered an inert substance" is receiving some confirmation. The record blanks of one consulting engineer have spaces for the chemical analyses of the materials used on every concrete job, including the water.

Mineralogical study of aggregates is being made increasingly, and to it we already owe the knowledge that the presence of some cherts and clay minerals in aggregates should cause them to be used cautiously or should bar them from use altogether. One correspondent writes that he has already begun the study of aggregate properties in connection with their geological characteristics, and while it looks like a lifetime job he thinks that it will be well worth taking on. It has already been shown that the geological characteristics of the limestone from which cement is made are an important factor in the resistance of concrete to alkali waters.

The newer study of concrete is also much concerned with the reasons for occasional instances of short life of concrete structures. It is the opinion of one correspondent that both under-sanded and over-sanded mixtures tend to be short lived, thus linking gradation with durability, as it has already been linked with strength and workability. This certainly holds true in so far as gradation affects permeability. While the effect on volume change is slight, it has been shown by Davis and Troxell that expansion is related to surface modulus.

Volume change is now being extensively studied. Goldbeck, in a recent paper, shows that very light slags when used as aggregates are the cause of greater expansion than would be found with ordinary aggregates and that sometimes this expansion may be dangerous. His recent work on the effects of freezing and thawing has shown that while variations in concrete materials (both cements and aggregates) undoubtedly affect the soundness of concrete, it is not always possible to predict from tests on materials whether they will make unsound concrete or not. Probably everyone will agree with his conclusion that tests on the soundness of concrete and concrete materials are the most important tests that can be made today, although this might have been disputed only a year or two ago. It is with just such matters, rather than theories of designing for strength, that the research of today is concerned.

Financial News and Comment

RECENT QUOTATIONS ON SECURITIES IN ROCK PRODUCTS CORPORATIONS

Stock	Date	Bid	Asked	Dividend
Allentown P. C. 1st 6's[27]	8-26-31	92	....	
Alpha P. C. new com.	8-25-31	13⅛	14¼	25c qu. July 25
Alpha P. C. pfd.	8-22-31	105	120	1.75 qu. June 15
Amalgamated Phosphate Co. 6's, 1936[27]	8-26-31	94½	96	
American Aggregates com.[27]	8-26-31	4	8	75c qu. Mar. 1
American Aggregates pfd.[27]	8-26-31	60	70	1.75 qu. July 1
Amer. Aggr. 6's w.w.[27]	8-26-31	61	63	
American Brick Co., sand-lime brick	5- 4-31	....	7	25c qu. Feb. 1, '30
American Brick Co. pfd.	5- 4-31	52¼	57	50c qu. May 1, '30
Am. L. & S. 1st 7's[27]	8-26-31	96	98	
American Silica Corp. 6½'s[39]	8-26-31	No market		
Arundel Corp. new com.	8-24-31	36 actual sale		75c qu. July 1
Beaver P. C. 1st 7's[20]	7-23-31	90	94	
Bessemer L. & C. Cl. A	8-25-31	17½	19	50c qu. Aug. 1
Bessemer L. & C. 1st 6½'s[27]	8-26-31	68	70	
Bloomington Limestone 6's[27]	8-26-31	40	45	
Boston S. & G. new com.[37]	8- 8-31	8½	11	15c qu. July 1
Boston S. & G. new 7% pfd.[37]	8- 8-31	36	39	87½c qu. July 1
California Art Tile A	8-22-31	....	5½	43¾c Mar. 31
California Art Tile B	8-22-31	....	1	20c qu. Mar. 31
Calaveras Cement com.	8-22-31	....	5	
Calaveras Cement 7% pfd.	8-22-31	....	78	1.75 qu. July 15
Canada Cement com.	8-25-31	9	10	
Canada Cement pfd.	8-25-31	84	85	1.62½ qu. Sept. 30
Canada Cement 5½'s[27]	8-26-31	98	99	
Canada Cr. St. Corp. bonds[27]	8-26-31	88	92	
Canada Crushed Stone com.[41]	7-21-31	....	13	
Canada Crushed Stone pfd.[41]	8-18-31	....	76½	
Certainteed Prod. com.	8-25-31	4¾	5	
Certainteed Prod. pfd.	8-25-31	23¼	33	1.75 qu. Jan. 1
Cleveland Quarries	8-25-31	....	62	75c qu. Sept. 1
Columbia S. & G. pfd.	8-26-31	86	92	
Consol. Cement 1st 6½'s, A[44]	8-26-31	10	20	
Consol. Cement Notes, 1941[27]	8-26-31	12	25	
Consol. Cement pfd.[27]	8-26-31	10	20	
Consol. Oka S. & G. pfd.[41] (Canada)	8-18-31	....	80	
Consol. Rock Prod. com.[9]	8-15-31	20c	40c	
Consol. Rock Prod. pfd.[9]	8-15-31	1	2	43¾c qu. June1,'30
Consol. Rock Prod. units	8-24-31	2	4	
Consol. S. & G. pfd. (Can.)	8-25-31	....	60	1.75 qu. Aug. 15
Construction Mat. com.	8-25-31	5½	7½	
Construction Mat. pfd.	8-25-31	25½	26	87½c qu. Aug. 1
Consumers Rock & Gravel, 1st Mtg. 6's, 1948[35]	8- 6-31	55	65	
Coosa P. C. 1st 6's[27]	8-26-31	40	45	
Coplay Cem. Mfg. 1st 6's[27]	8-26-31	85	87	
Coplay Cem. Mfg. com.[27]	8-26-31	5	7	
Coplay Cem. Mfg. pfd.[27]	8-26-31	25	40	
Dolese & Shepard	8-25-31	33	38	$1 qu. July 1
Dufferin Pav. & Cr. Stone com.	8-25-31	6	....	
Dufferin Pav. & Cr. Stone pfd.	8-25-31	....	67	1.75 qu. July 2
Edison P. C. com.[32]	8- 7-31	1½	....	
Edison P. C. pfd.[32]	8- 7-31	5	....	
Federal P. C. 6½'s, 1941[27]	8-26-31	95	97	
Giant P. C. com.[27]	8-26-31	2	4	
Giant P. C. pfd.[27]	8-26-31	7	13	1.75 s.-a. Dec. 15
Gyp. Lime & Alabastine, Ltd.	8-25-31	7	7½	20c qu. June 30
Gyp. Lime & Alabastine 5½'s	8-18-31	80	85	
Hermitage Cement com.[27]	8-26-31	16	19	
Hermitage Cement pfd.[27]	8-26-31	73	77	
Ideal Cement, new com.	8-25-31	30	31½	75c qu. July 1
Ideal Cement 5's, 1943[29]	8- 8-31	99½	101	
Illinois Electric Limestone 1st 7's[38]	8- 8-31	92½	98½	
Indiana Limestone com.[27]	8-26-31	....	2	
Indiana Limestone pfd.[27]	8-26-31	....	40	
Indiana Limestone 6's	8-21-31	26	....	
International Cem. com.	8-25-31	31	32	$1 qu. Sept. 30
International Cem. bonds 5's	8-25-31	83	....	Semi-ann. int.
Iron City S. & G. bonds 6's[36]	6-26-31	80	90	
Kelley Is. L. & T. new stock	8-25-31	....	24	50c qu. July 1
Ky. Cons. St. V. T. C.	8-25-31	4	5½	
Ky. Cons. Stone 6½'s[38]	8- 8-31	70	80	
Ky. Cons. Stone com.	8-25-31	4	5½	
Ky. Cons. Stone pfd.	8-25-31	....	77½	1.75 qu. May 1
Ky. Rock Asphalt com.	8-25-31	3¾	4¼	40c qu. Oct. 1, '30
Ky. Rock Asphalt pfd.	8-25-31	....	60	1.75 qu. Sept. 1
Ky. Rock Asphalt 6½'s	8-25-31	83	87½	
Ky. Rock Asphalt war.	8-25-31	2	4	
Lawrence P. C.	8-22-31	38	43	$1 qu. June 30
Lawrence P. C. 5½'s, 1942[2]	8- 9-31	78	84	
Lehigh P. C.	8-25-31	10	11	25c qu. May 1
Lehigh P. C. pfd.	8-25-31	89¼	95	1.75 qu. Oct. 1
Louisville Cement[45]	8-25-31	175	225	
Lyman-Richey 1st 6's, 1932[27]	8-26-31	96	98	
Lyman Richey 1st 6's, 1935[27]	8-26-31	92	95	
Marblehead Lime 6's[14]	8- 7-31	90	....	
Marbelite Corp. com.[35] (cement products)	8- 6-31	....	2	
Marbelite Corp. pfd.[35]	8- 6-31	1	......	50c qu. Oct. 10, '30
Material Service Corp.	8-25-31	17¼	18½	50c qu. June 1
McCrady-Rodgers 7% pfd.[22]	8- 6-31	45	47	87½c qu. June 30
McCrady-Rodgers com.[22]	8- 6-31	15	20	75c qu. Jan. 26
Medusa Portland Cement	8-25-31	....	33	75c qu. Apr. 1
Michigan L. & C. com.[6]	8- 7-31	50	....	
Missouri P. C.	8-25-31	20	20½	50c qu. July 31
Monolith Portland Midwest[9]	8-15-31	1	1½	
Monolith P. C. com.	8-24-31	1½	3	40c s.-a. Jan. 1
Monolith P. C. pfd.	8-24-31	3	5	40c s.-a. Jan. 1
Monolith P. C. units[9]	8- 7-31	5	7	
Monolith P. C. 1st Mtg. 6's[9]	8- 7-31	73	77	
National Cem. (Can.) 1st 7's[34]	7-24-31	101	....	
National Gypsum A com.	8-25-31	3½	3¾	
National Gypsum pfd.	8-25-31	46	49	1.75 Oct. 1
Nazareth Cement com.[25]	8- 8-31	5	12	
Nazareth Cement pfd.[25]	8- 8-31	75	85	
Newaygo P. C. 1st 6½'s[27]	8-26-31	98	100	
New England Lime 6's, 1935[27]	8-26-31	30	32	
N. Y. Trap Rock 1st 6's	8-21-31	95	95½	
N. Y. Trap Rock 7% pfd.[30]	8- 7-31	95	....	1.75 qu. July 1
North Amer. Cem. 1st 6½'s	8-22-31	40 actual sale		
North Amer. Cem. com.[27]	8-26-31	50c	1	
North Amer. Cem. 7% pfd.[27]	8-26-31	8	10	
North Shore Mat. 1st 5's[15]	8-26-31	80	....	
Northwestern States P. C.[31]	8- 8-31	95	....	$2 Apr. 1
Ohio River Sand com.	8-25-31	....	14	
Ohio River Sand 7% pfd.	8-25-31	....	98	
Ohio River S. & G. 6's[16]	8- 9-31	80	90	
Oregon P. C. com.[9]	8- 7-31	8	12	
Oregon P. C. pfd.[9]	8- 7-31	80	85	
Pacific Coast Aggr. com.[40]	8- 7-31	....	75c	
Pacific Coast Aggr. pfd.[40]	8- 7-31	....	1½	
Pacific Coast Cement 6's[5]	8- 6-31	54	56	
Pacific P. C. com.	8-22-31	....	12	
Pacific P. C. pfd.	8-22-31	....	65	1.62½ qu. July 3
Pacific P. C. 6's[5]	8- 6-31	99	....	
Peerless Cement com.[1]	8- 7-31	1	1½	
Peerless Cement pfd.[1]	8- 7-31	22	33	1.75 qu. Apr. 1
Penn.-Dixie Cement com.	8-25-31	1¾	2	
Penn.-Dixie Cement pfd.	8-25-31	7	8	
Penn.-Dixie Cement 6's	8-25-31	56 actual sale		
Penn. Glass Sand Corp. 6's	8- 5-31	100	102	
Penn. Glass Sand Corp. pfd.	7- 8-31	90	....	1.75 qu. July 1
Petoskey P. C.	8-25-31	....	5	15c qu. Apr. 1
Port Stockton Cem. com.[9]	8-22-31	No market		
Riverside Cement com.	8-22-31	....	13	
Riverside Cement pfd.	8-24-31	57	60	1.50 qu. Aug. 1
Riverside Cement, A[9]	8-15-31	6½	10	15c qu. Feb. 1
Riverside Cement, B	8-15-31	75c	1	
Roquemore Gravel 6½'s[17]	8-25-31	98	100	
Sandusky Cement 6½'s, 1931-37[27]	8-26-31	95	100	
Santa Cruz P. C. com.	8-22-31	84	....	$1 qu. July 1
Schumacher Wallboard com.	8-22-31	6⅛	11	25c qu. June 27
Schumacher Wallboard pfd.	8-22-31	14	22	50c qu. Aug. 15
Southwestern P. C. units[35]	8- 6-31	235	275	
Standard Paving & Mat. (Canada) com.	8-25-31	5⅛	5½	50c qu. May 15
Standard Paving & Mat. pfd.	8-25-31	60	....	1.75 qu. Aug. 15
Superior P. C., A	8-22-31	37½	38½	27½c mo. Sept. 1
Superior P. C., B[9]	8-15-31	9	10	25c qu. Mar. 20
Trinity P. C. units[31]	8- 8-31	95	112	
Trinity P. C. com.[31]	8- 8-31	17	....	
Trinity P. C. pfd.[27]	8-11-31	90	....	
U. S. Gypsum com.	8-25-31	37	38¼	40c qu. Sept. 30
U. S. Gypsum pfd.	8-25-31	132	....	1.75 qu. Sept. 30
Wabash P. C.[21]	8- 9-31	....	22	
Warner Co. com.[16]	8- 9-31	23	23½	25c qu. Oct. 15
Warner Co. 1st 7% pfd.[16]	8- 9-31	90	94	1.75 qu. Oct. 1
Warner Co. 1st 6's[8]	8-26-31	81	83	
Whitehall Cem. Mfg. com.[30]	8- 7-31	75	....	
Whitehall Cem. Mfg. pfd.[30]	8- 7-31	50	....	
Wisconsin L. & C. 1st 6's[15]	8-26-31	No market		
Wolverine P. C. com.	8-25-31	....	4	15c qu. Nov. 15
Yosemite P. C., A com.[9]	8-15-31	....	10	

Quotations by: [1]Watling Lerchen & Hayes Co., Detroit, Mich. [2]Bristol & Willett, New York. [3]Rogers, Tracy Co., Chicago. [4]Butler, Beadling & Co., Youngstown, Ohio. [5]Smith, Camp & Riley, San Francisco, Calif. [6]Frederick H. Hatch & Co., New York. [7]J. J. B. Hilliard & Son, Louisville, Ky. [8]Dillon, Read & Co., Chicago, Ill. [9]A. E. White Co., San Francisco, Calif. [10]Lee Higginson & Co., Boston and Chicago. [11]J. W. Jakes & Co., Nashville, Tenn. [12]James Richardson & Sons, Ltd., Winnipeg, Man. [13]Stern Bros. & Co., Kansas City, Mo. [14]First Wisconsin Co., Milwaukee, Wis. [15]Central Trust Co. of Illinois. [16]J. S. Wilson, Jr., Co., Baltimore, Md. [17]Citizens Southern Co., Savannah, Ga. [18]Dean, Witter & Co., Los Angeles, Calif. [19]Hewitt, Ladin & Co., New York. [20]Tucker, Hunter, Dulin & Co., San Francisco, Calif. [21]Baker, Simonds & Co., Inc., Detroit, Mich. [22]Peoples-Pittsburgh Trust Co., Pittsburgh, Penn. [23]A. B. Leach & Co., Inc., Chicago, Ill. [24]Richards & Co., Philadelphia, Penn. [25]Hincks Bros. & Co., Bridgeport, Conn. [26]Bank of Republic, Chicago, Ill. [27]National City Co., Chicago, Ill. [28]Chicago Trust Co., Chicago, Ill. [29]Boettcher & Co., Denver, Colo. [30]Hanson and Hanson, New York. [31]S. F. Holzinger & Co., Milwaukee, Wis. [32]Tobey and Kirk, New York. [33]Steiner, Rouse and Co., New York. [34]Jones, Heward & Co., Montreal, Que. [35]Tenney, Williams & Co., Los Angeles, Calif. [36]Stein Bros. &Boyce, Baltimore, Md. [37]Wise, Hobbs & Arnold, Boston. [38]E. W. Hays & Co., Louisville, Ky. [39]Blythe Witter & Co., Chicago, Ill. [40]Martin Judge Co., San Francisco, Calif. [41]A. J. Pattison Jr. & Co. Ltd., Toronto, Canada. [42]Nesbitt, Thomson & Co., Montreal. [44]E. H. Rollins, Chicago. [45]Dunlap, Wakefield & Co., Louisville, Ky.

Southern Asbestos Co. Report

NET EARNINGS of the Southern Asbestos Co., Charlotte, N. C., for the six months ending June 30, 1931, are reported as $8,993, after depreciation.

The comparative balance sheet as of June 30 follows:

ASSETS

	1931	1930
*Plant and equipment	$ 461,732	$ 474,447
Processes, formulas, etc.	518,000	518,000
Investment	19,950	19,950
Current assets:		
Cash	5,489	102,156
Accounts, etc., receivable	42,965	
Due from affiliated companies	120,531	....
Materials and supplies	215,353	448,437
Deferred charges	8,139	5,105
Total	$1,392,159	$1,568,095

LIABILITIES

	1931	1930
†Capital stock	$1,503,200	$1,423,954
Surplus	(d)121,131	
Cancellation of contracts	....	40,336
Current liabilities:		
Accounts payable, etc.	10,089	4,870
Salaries and wages		3,765
Credit balance (accounts receivable)		41,113
Federal taxes		4,057
Reserve for contingencies	....	50,000
Total	$1,392,159	$1,568,095
Current assets	$ 384,338	$ 550,593
Current liabilities	10,089	53,806
Working capital	$ 374,249	$ 496,787

*Less depreciation: 1931, $123,298; 1930, $101,345. †Represented by 89,960 no par shares.

Asbestos Corp. of Canada

MEETING of first mortgage bondholders of Asbestos Corp. of Canada, Ltd., subsidiary of Asbestos Corp., Ltd., recently held to act on a proposal for cancellation of bonds which have been purchased or called for sinking fund, has been adjourned to August 28, due to lack of quorum. Proposed action would relieve parent company of its interest obligations on this issue, only a small amount of which remains outstanding.

Reports on Johns-Manville Earnings

JULY BUSINESS of Johns-Manville Corp., New York, N. Y., showed less than the usual seasonal decline from June. While the volume is still distinctly subnormal the trend, therefore, is somewhat encouraging.

The cut in operating expenses, moreover, has greatly helped the profit margin. For instance profit margin in the second quarter was 8.3c. per dollar of sales, against 3.2 in the first quarter.

For the first time since the acute depression set in, moreover, the ratio of net profits before taxes to sales was equal in the second quarter to that of the same period of the year before, and this on a sales aggregate 28% lower—$9,618,000 against $13,397,000. In both the second quarter of this year and last the figure was 8.3%.

In the first quarter of this year the comparison was unfavorable, 3.2% against 7%. The drop in sales was 35%. Similarly, in the fourth quarter of 1930 the profit margin was 3.4% against 7.7% the year before.

Johns-Manville for the second quarter more than covered its 75c. dividend, actual balance being 78c. a share. That brought the half-year total up to 91c. a share on the 750,000 shares of common.—*Wall Street* (N. Y.) *Journal.*

Standard Paving Omits Common Dividend

THE DIRECTORS of the Standard Paving and Materials Co., Ltd., Toronto, Canada, recently decided to omit the quarterly dividend ordinarily payable about August 15 on the common stock, no par value. From May 15, 1929, to and including May 15, 1931, the company made regular quarterly distributions of 50c per share on this issue.

Action was deferred in order to maintain a liquid position until it is possible to estimate the earnings for the current year more definitely.

The Standard Paving Nova Scotia, Ltd., a subsidiary, with headquarters in Halifax, has been organized. E. L. Miles has been appointed general manager of the new branch of this company.

Ready-Mixed Concrete Co. Shows Earnings

READY-MIXED CONCRETE CO., Knoxville, Tenn., earned a profit of $5,396.17 between July 13, when it was put into receivership, and July 30, according to a report filed in chancery court.

Payments on conditional sales contracts were authorized by Robert McCampbell, receiver.—*Knoxville* (Tenn.) *Journal.*

Recent Dividends Announced

Canada Cement pfd. (qu.)	1.62½	Sept. 30
Cleveland Quarries com. (qu.)	0.75	Sept. 1
International Cement com. (qu.)	1.00	Sept. 30
Ky. Rock Asphalt pfd. (qu.)	1.75	Sept. 1
Lehigh P. C. pfd. (qu.)	1.75	Oct. 1
United States Gypsum com. (qu.)	0.40	Sept. 30
United States Gypsum pfd. (qu.)	1.75	Sept. 30
Warner Co. com. (qu.)	0.25	Oct. 15
Warner 1st and 2nd pfd. (qu.)	1.75	Oct. 1

Comparative Consolidated Balance Sheet of the United States Gypsum Co.

THE comparative consolidated balance sheets of the United States Gypsum Co., Chicago, Ill., and subsidiary companies as of June 30, 1931 and 1930 follows:

COMPARATIVE CONSOLIDATED BALANCE SHEETS

ASSETS

	June 30, 1931	June 30, 1930
Current assets:		
Bank balances and working funds	$ 540,095.07	$ 943,155.98
Marketable securities, including accrued interest—at cost—U. S. Government securities	8,589,110.08	6,044,387.84
Municipal bonds	1,020,614.36	....
Accounts, notes, and construction contracts receivable—Less reserves for bad debts	4,622,786.08	4,895,032.66
Inventories of finished goods, raw materials, supplies, etc., priced at cost which is not in excess of market	3,799,501.95	4,288,183.96
Total current assets	$18,572,107.54	$16,170,760.44
Stock subscriptions receivable, investments, etc.:		
Employes' stock purchase contracts	$ 1,651,870.36	$ 1,630,043.57
Bonds on deposit for insurance reserve, including interest—at cost	180,867.98	132,189.58
Miscellaneous stocks and bonds—at book value	87,821.56	144,109.20
Total	$ 1,920,559.90	$ 1,906,342.35
Plant and equipment—at book value:		
Land, gypsum, buildings, machinery, steamers, etc.	$61,370,768.04	$58,359,301.40
Less—Reserves for depreciation and depletion	11,973,487.92	9,978,344.95
	$49,397,280.12	$48,380,956.45
Deferred charges:		
Stripping costs, amortizable patent expenditures and prepaid expenses	$ 1,043,776.47	$ 939,433.64
Total assets	$70,933,724.03	$67,397,492.88

LIABILITIES

	June 30, 1931	June 30, 1930
Current liabilities:		
Accounts payable	$ 694,741.54	$ 662,815.36
Accrued liabilities—		
Payrolls, local taxes, etc.	293,838.94	290,120.53
Federal income taxes	634,155.51	668,681.66
Total current liabilities	$ 1,622,735.99	$ 1,621,617.55
Reserves:		
Contingencies	$ 903,012.32	$ 903,012.32
Accident insurance, guarantees, etc.	501,357.41	545,917.11
Total	$ 1,404,369.73	$ 1,448,929.43
Capital stock and surplus:		
Capital stock—		
7% cumulative preferred—$100.00 par value	$ 7,841,700.00	$ 7,841,700.00
Common—$20.00 par value	24,339,120.00	23,409,440.00
	$32,180,820.00	$31,251,140.00
Surplus—		
Paid-in surplus	$ 6,496,401.43	$ 5,541,442.35
Earned surplus	29,229,396.88	27,534,363.55
	$35,725,798.31	$33,075,805.90
Net worth	$67,906,618.31	$64,326,945.90
Total liabilities	$70,933,724.03	$67,397,492.88
Net working capital	$16,949,371.55	$14,549,142.89

Traffic and Transportation

Proposed Changes in Rates

THE following are the latest proposed changes in freight rates up to the week of August 22:

NEW ENGLAND FREIGHT ASSOCIATION DOCKET

23245. **Crushed stone (trap rock)**, (See Note 3), from Westfield, Mass., to Bondsville, Mass. Present rate, 90c per net ton; proposed, 50c. (To expire September 1, 1932.) Reason—To establish commodity rate to meet nearby crusher.

CENTRAL FREIGHT ASSOCIATION DOCKET

28437. White Docket Advice No. 28437, dated May 1, 1931, published in Docket Bulletin No. 1982, covering proposition to establish revised rates on **fluxing stone**, from Fultonham and White Cottage, O., to Ashland, Ky., Ironton and Portsmouth, O., is hereby withdrawn from the docket.

29135. To establish on **crushed stone, crushed stone screenings, tailings, agricultural limestone, unburned**, in bulk (See Note 3), from Limedale and Greencastle, Ind., to Ladoga and Whitesville, Ind.; present rate, 65c per net ton; proposed, 60c.

29139. To establish on **stone, rip rap**, in open cars, **stone, rough** (not dimension), in open cars, **stone, rubble**, in open cars, carloads, from Marble Cliff, O., to Chicago, Ill., present 23½ per 100 lb., proposed $2.77 per net ton; to Detroit, Mich., present 20c, proposed $2.02.

29141. To establish on **grinding sand**, carloads (See Note 3), provided that on cars with marked capacity of over 110,000 lb. the minimum weight will be 110,000 lb., from Muskegon, Mich., to Rossford, O.; present rate, 126c; proposed, 101c per net ton.

29149. To cancel rates on **stone, crushed, coated with oil, tar or asphaltum**, carloads (See Note 3), from Columbus, O., to points in Central Freight Association territory, on account obsolete.

29159. To establish on **sand**, viz., **lake, river and bank**, other than sand loam, carloads, from Michigan City, Ind., to Centerpoint, Ind. Present rate, 20½c per 100 lb.; proposed, $1.90 per net ton.

29173. To establish rate on **sand (lake, river and bank**, other than sand loam), carloads, from Gary, Miller (Lake county) and Willow Creek, Ind., to points in Illinois (rates in cents per net ton):

To	Pres.	Prop.	To	Pres.	Prop.
Danville	164	139	Quincy	214	177
Decatur	176	139	East St. Louis	214	189
Hoopeston	164	139	St. Louis	214	189
Litchfield	189	151	Springfield	189	139

27497. **Stone, crushed or quarry broken**, carloads (See Note 1), from Munns and Oriskany Falls, N. Y. (rates in cents per net ton):

To	Rate	To	Rate
Jermyn, Penn.	125	Sidney, N. Y.	85
Jermyn Transfer, Penn.	125	New Berlin Jct.	85
		Parker, N. Y.	85
Mayfield, Penn.	125	Guilford, N. Y.	85
Carbondale, Penn.	125	Oxford, N. Y.	85
Forest City, Penn.	125		

Reason—Proposed rates are comparable with rates from Schoharie, N. Y.

29209. To amend Item 1670B of C. F. A. L. Exceptions to Official Classification Tariff No. 130T, publishing rates on **limestone, crushed, ground or pulverized**, carloads, minimum weight 60,000 lb., from various points in Illinois to C. F. A. and arbitrary territories by adding "Cox, Ill.," as an additional point of origin.

29213. To establish on **sand and gravel**, carloads, from Fairview and Swanville, Penn., to Kaylor, Penn., rate of 130c per ton. Present rate, sixth class.

29219. To establish on **crushed marble**, carloads (See Note 3), from Gantts Quarry, Ala., to Indianapolis, Ind., rate of 386c per net ton. Present rate, 371.

TRUNK LINE ASSOCIATION DOCKET

27480. **Sand**, carloads (See Note 1), from Hopatcong Junction and Kenvil, N. J., to Bound Brook, Somerville, Dunellen, Lincoln, N. J., 80c; Jersey City, Newark, Brills, Kearny, Bayonne, Bayway, Elizabethport, Elizabeth, Roselle, Cranford, Westfield and Garwood, N. J., 75c per net ton. (See Note 4.)

27481. **Crushed stone coated with oil, tar or asphaltum**, carloads (See Note 1), from White Haven, Penn., D. L. & W. R. R., Elmhurst and Nay Aug, Penn., $1.20; Gouldsboro and Tobyhanna, Penn., $1.30; Erie R. R., Elmhurst, Penn., $1.25; Gravity, Hoadleys, Lake Ariel, Penn., $1.40; Hawley, Kimbels, Reeders, Penn., $1.50; Maplewood and Saco, Penn., $1.35; Port Jervis, N. Y., $1.70; Scranton, Penn., $1.15; Reading Co., Ringtown, Penn., $1.35; Tamaqua, Penn., $1.15. The above rates per net ton. Reason—The proposed rates reflect the usual 10c per net ton over the present crushed stone rates.

27485. **Stone, broken or crushed**, carloads (See Note 1), from Oriskany Falls, N. Y., to Rockwells Mills, N. Y., $1 per net ton. Present rate, $1.10 per net ton. Reason—Proposed rate merely comparable with rates from Jamesville, N. Y., to Rockwells Mills, N. Y.

27489. **Stone, natural**, other than bituminous asphalt rock, crushed, coated with oil, tar or asphaltum, carloads (See Note 1), from Bethlehem, Penn., to Hudsondale, Penn., $1.10 per net ton. (See Note 4.)

27517. **Dolomite** (magnite), **burnt or roasted**, carloads (See Note 1), from Natural Bridge, N. Y., to Phoenixville, Penn., $2.70 per net ton. Present rate, 16c per 100 lb. Reason—Proposed rate compares favorably with rate from Natural Bridge, N. Y., to Pittsbugh, Penn.

Sup. 1 to 27210. (A) **Building sand**, carloads, (B) **engine, blast, glass, molding sand and ground flint**, carloads (See Note 1), from Hancock and Round Top, Md., to Montrose, Penn., (A) $2.40 and (B) $2.60 per net ton.

Note 1—Minimum weight marked capacity of car.

Note 2—Minimum weight 90% of marked capacity of car.

Note 3—Minimum weight 90% of marked capacity of car, except that when car is loaded to visible capacity the actual weight will apply.

Note 4—Reason—To meet motor truck competition.

Note 5—Reason—Proposed rates are comparable with rates on like commodities for like distances, services and conditions.

27520. To cancel present commodity rates on **limestone, unburned, ground**, carloads, minimum weight 50,000 lb., from Coldwater, N. Y., to points on the B. R. & P. Ry., L. V. R. R. and Pennsylvania R. R.; from Medina and Cambria, N. Y., to points on the B. R. & P. Ry., D. L. & W. R. R., B. & S. R. R., P. S. & N. R. R., L. V. R. R., P. R. R. and Erie R. R., classification basis to apply. Reason—Investigation develops there has been no movement for some time and no prospect of future movement, therefore rates are obsolete.

27521. **Sand and gravel**, carloads (See Note 1), from Kenvil and Hopatcong Junction, N. J., to Tamaqua, Penn., $1.30 per net ton. Present rate, $1.60. (See Note 5.)

27523. **Crushed stone**, carloads, and **sand and gravel**, other than blast, engine, foundry, glass, molding or silica, carloads (See Note 1), from Le Roy and Rochester, N. Y., to Lakeville, N. Y., 65c per net ton. Reason—To meet motor truck competition.

27524. **Sand and gravel**, carloads (See Note 1), from Kenvil and Hopatcong Junction, N. J., to points in Pennsylvania:

To	Prop.	To	Prop.
Catasauqua	$1.00	White Haven	$1.20
Walnutport	1.00	Wilkes-Barre	1.30
Palmerton	1.00	Hauto	1.10
Lehighton	1.10	Nesquehoning	1.10
Weissport	1.10	Audenried	1.20
Mauch Chunk	1.10	(See Note 5)	

27531. **Stone, natural** (other than bituminous asphalt rock), **crushed**, carloads (See Note 1), from Oaks Corners, N. Y., to Tioga, Hammond, Hills Creek, Holiday, Middleburg, Niles Valley, Wellsboro Jct., Wellsboro, Brownlee and Antrim, Penn., $1.20 per net ton. (See Note 5.)

27533. **Crushed stone and screenings**, carloads (See Note 1), from Havre-de-Grace, Md., to points on the B. & O. R. R., Point of Rocks, Rohrersville, Security, Hagerstown, Md., Engle, Martinsburg, Charles Town (Jefferson County), W. Va., Winchester, Stephens City, Capon Road and Strasburg, Va., and various, rates ranging from $1.20 to $1.40 per net ton. (See Note 5.)

I. C. C. Decisions

22109. Sand. The commission, in the matter of rates on sand, gravel, crushed stone, etc., within the state of South Carolina, has ordered the replacement of rates on the commodities mentioned required by the authority of the South Carolina commission, not later than October 12, by rates made in accordance with the scale prescribed for application on interstate traffic in Rates on Chert, Clay, Sand and Gravel Within State of Georgia, 160 I. C. C. 309. The original report in that case was made in 122 I. C. C. 133 and a later report in 140 I. C. C. 85. The rates therein were made in accordance with what is called, in this report, the 17517 scale.

This proceeding was initiated by a petition of the Atlantic Coast Line, Seaboard Air Line, the Southern and ten short line railroads to determine the quality of the rates maintained by them in accordance with the order of the South Carolina commission of August 24, 1928. The South Carolina commission prescribed but a single-line scale to be used for all hauls whether single-line or joint-line, distances to be computed over the shortest possible routes over which traffic could be moved without transfer of lading. The state commission further said that there should be no differential for the so-called weak or short lines. The federal scale provided for single and joint-line rates up to distances of 480 mi. For distances under 320 mi. the South Carolina scale was the same as the 17517 scale.

The Commission found the rates maintained by the petitioning railroads, respondents in this proceeding, for application within South Carolina, generally to be unduly prejudicial to interstate shippers, unduly preferential of intrastate shippers and unjustly discriminatory against interstate commerce to the extent hereinbefore indicated. The order requires the removal of the undue prejudice, undue preference and unjust discrimination by the making of rates in accordance with single and joint-line scales set forth in an appendix for distances up to and including 320 mi. heretofore found reasonable for interstate transportation in No. 17517, the Georgia sand and gravel case, 160 I. C. C. 309.

23521. Concrete Sewer Pipe. Shreveport, La., Chamber of Commerce on behalf of Shearman Concrete Pipe Co. et al., vs. St. Louis Southwestern et al. By division 3. The Commission found the rate on concrete sewer pipe from Shreveport, La., to Tyler, Tex., unreasonable to the extent it exceeded 18c. on shipments over a 110.4-mi. route and 24c. on shipments that moved over a 220-mi. route. Reparation awarded. Chairman Brainerd concurred because he said the decision accorded with previous decisions but he said that he was of the opinion that reparation to a lower basis should have been awarded.

22420. Sand and Gravel. Missouri Gravel Co. vs. C. B. & Q. et al. By division 4. The Commission found the rates on sand and gravel from La Grange, Mo., to Industry and Littleton, Ill., unreasonable to the extent that the factor thereof to Ma-

comb, Ill., exceeded 79c. a net ton and the factors beyond Macomb exceeded 42c. Reparation awarded. Commissioner Mahaffie dissented.

Proposed Reports in I. C. C. Cases

23898. Cement. Iola Cement Mills Traffic Association et al., vs. A. T. & S. F. et al., embracing also No. 23899, Southwestern Portland Cement Co. vs. T. & P. et al.; No. 23902, Oklahoma Portland Cement Co. vs. A. T. & S. F. et al.; No. 23995, San Antonio Portland Cement Co. vs. I.-G. N. et al.; No. 24133, Republic Portland Cement Co. vs. G. C. & S. F. et al., by Examiner Morris H. Konigsberg. Proposes that Commission find that the rates on cement from the Kansas gas belt and Dewey, Okla., to destinations on the Texas-New Mexico Railway Co. and from Ada, Okla., El Paso, Cementville, Longhorn, Eagle Ford, and Harrys, Tex., to points in New Mexico on the Texas-New Mexico were, are and for the future will be unreasonable and unduly prejudicial to the extent they exceeded or may exceed Scale IV rates as set forth on page 87 in appendix B in Oklahoma Portland Cement Co. vs. D. & R. G., 128 I. C. C. 63. Examiner said establishment of rates herein found reasonable on interstate traffic would remove the alleged unjust discrimination against interstate commerce. Reparation proposed.

Presents Sand and Gravel Case on Rate Increase

ON SEPTEMBER 14 the National Sand and Gravel Association, on behalf of the sand and gravel industry, submitted a statement to the Interstate Commerce Commission in connection with the application of the railroads for a horizontal increase of 15% in rates on all freight traffic. This statement was presented by V. P. Ahearn, executive secretary of the Association.

Mr. Ahearn first told of the extent of the Sand and Gravel Association and other associations which he represented, saying that together they represented 65% of the total output of the country. He then pointed out that this industry ranks fourth in volume among the commodities handled by the railroads and ranks ninth in revenue to the railroads. It was also said that this business is largely of short-haul character. He then told of the growth in the sand and gravel industry, citing the increase in tonnage produced from 1902 to 1929. An exhibit was then introduced showing the production record over an extended period of time, and the shipments by rail for this period. In presenting this exhibit it was pointed out that from 1917 to 1929 the production of these materials increased 170% while railroad volume increased but 12%. It was pointed out that this was evidence of the fact that other means of transportation are being used in increasing proportion. It was also pointed out that in 1921 the railroads handled 50.8% of the total production of sand, gravel and crushed stone while in 1929 their proportion had declined to 41.1%.

In a second exhibit a chart presented graphically car loadings and production from 1921 to 1930 and attention was called to the increasing loss in business to railroads under present conditions.

A third exhibit consisted of a digest prepared by Mr. Ahearn of answers to six questions to members regarding the proposed rate increase. Replies from approximately fifty large producers were unanimous in expressing the belief that the proposed increase would result in further diverting railroad movements of these commodities to other forms of transportation and that it would enable wayside pit operations to make further inroads on the business of established producers. There was also unanimity in the opinion that present rates had encouraged many wayside pit operations and that lower rates would develop additional rail shipments. Of 47 producers, 44 representative producing companies in various parts of the country insisted carriers would suffer a decline in revenue, should the proposed rate increase be established. In answer to a fifth question conclusive opinions were expressed by producers that the sand and gravel industry is faced with equally as important financial problems as the railroads and that it is facing a critical period in its history that would be aggravated by an increase in freight rates. Answers to the final question in this exhibit indicated that during the period from 1920 to 1930 there has been a decided trend away from railroad transportation of sand and gravel to the disadvantage of both railroads and established producers and the opinion was universally held that any increase in sand and gravel freight rates would result in further replacement of the railroad as a means of transporting sand and gravel.

In a fourth exhibit 24 producers in whose territories rates on sand and gravel had been voluntarily reduced by the railroads below the maximum level authorized by the I. C. C., cited specific instances of such reductions. Statements of various of these producers were included as to reasons for these reductions. Other statements showed definite evidence of material increase in volume of business as the result of these reductions.

After this presentation of the general case of the industry by Mr. Ahearn, Alex W. Dann of the Keystone Sand and Supply Co., Pittsburgh, Penn., G. W. Renwick, vice-president, Chicago Gravel Co., Chicago, Ill., and Rollan J. Windrow, president, Dallas Washed and Screened Gravel Co., Dallas, Tex., introduced evidence as to the effect of the proposed increase in their respective districts. As reported by the *Charlotte* (N. C.) *Observer,* Mr. Dann presented a statement showing railroads had lost much of this type of business to trucks and water lines and stood to lose more if rates were permanently increased.

Mr. Renwick said that in the Chicago district much tonnage had left the railroads during the last three years for trucks, and that any increase would accentuate this trend.

The belief also was expressed by Mr. Windrow, as representative of the Texas Crushed Stone, Sand and Gravel Association, that diversion to truck hauls would follow increases. His testimony ended the presentation of the sand and gravel industry.

The present status of this matter is that the Association is now preparing a brief to incorporate all of the industry's arguments, which will be submitted to the Commission by September 1. An oral argument will then be made before the full Commission in Washington, D. C., about September 15, and it is believed that the final decision in Ex Parte 103 of the Commission will be announced about October 1.

Other testimony offered by producers of rock products was presented by F. E. Paulson, of Allentown, Penn., vice-president of the Lehigh Portland Cement Co., who testified in opposition to any increase in freight rates on cement or the commodities which are used in the manufacture of cement. The diversion to motor trucks of cement traffic has been increasing since 1920, Mr. Paulson asserted, says the *New York* (N. Y.) *Herald Tribune,* and an increase in rates at this time would add to this diversion. As to inbound traffic on materials used in the manufacture and sale of cement, he said an increase of 15% in freight charges would add 4c. a bbl. to the cost of manufacturing cement, which cannot be passed along to the consumer under present conditions.

Further testimony was offered by C. A. Fulton of Baltimore, Md., representing fertilizer companies, mining phosphate rock in Florida and Tennessee, who predicted heavy losses of tonnage to water lines. He said about half the traffic being hauled by railroads could be diverted to water lines.

Mr. Fulton also protested any increase in railroad charges for handling phosphate at seaports.

Special Phosphate Rates May Be Granted in Alabama

A REDUCTION OF RATES on carload lots of phosphate rock and phosphate limestone from the Mount Pleasant district in Tennessee to Mobile for shipment to the Pacific Coast, requested by the traffic department of the Mobile Chamber of Commerce, will be granted by the Louisville and Nashville railroad shortly, it was stated at the Mobile chamber.

The reduction was asked on short notice because of an emergency, it was stated, which the traffic department of the carrier has recognized.

Because of the lower rate prevailing from the phosphate regions of Tennessee to Pensacola it was feared that the Mobile traffic would be diverted to Pensacola.—*Montgomery* (Ala.) *Advertiser.*

Investigate Paving Contracts in New York Borough

A SWEEPING INVESTIGATION of the administration of Borough President George U. Harvey and the affairs of the New York City Airport, Inc., and the Colonial Sand and Gravel Co., both of Flushing, N. Y., has been promised by Samuel Seabury, counsel for the Hofstadter legislative committee.

Given free rein by Governor Roosevelt's decision dismissing the charges against the borough president, Mr. Seabury announced that the inquiry would go deep into the political affairs of the borough.

In its phase of the borough-wide investigation, Mr. Seabury will summon Commissioner Halleran, Mr. Harvey, Laurence B. Halleran, all officials, directors and shareholders of the company to tell what they know about the affairs of the concern.

Investigation of the Colonial Sand and Gravel Co., Mr. Seabury revealed, will center about charges that the company consistently has been the low bidder on city building and paving contracts.

Mr. Seabury intimated he has authoritative information that the Colonial company is controlled by Queens political powers and has a monopoly in selling its product to the city.—*Richmond Hill* (N. Y.) *Commercial.*

Plan to Buy Sand by Weight Probed

CITY ENGINEER ELSBERG recently started an investigation to determine the advisability of buying sand and gravel by weight rather than measure in Minneapolis. The investigation was ordered by the council paving committee at the instigation of R. J. Ackerman, superintendent of licenses, weights and measures.

There are two cases pending in municipal court against local firms arising from charges that they gave the city short measure on gravel for paving jobs, Mr. Ackerman said. It was explained by representatives of the two companies that it was up to city inspectors on jobs to measure loads and mark the shortage on each delivery ticket.—*Minneapolis* (Minn.) *Star.*

Fire Protection Appliance List Contains Rock Products Manufacturers

A LIST of inspected fire protection appliances has been issued by the National Board of Fire Underwriters dated July, 1931. This list gives the rating of appliances which it covers, then lists the manufacturers who are using the inspection service of the laboratory. Included in the list are acoustical material, asbestos board and hollow concrete building units. Forty-five producers of these units are shown as using the service of the Underwriters.

Fight Ten-Cent Road Levy

PROTEST AGAINST a 10c gravel road repair levy in the new county budget, which has not come into the open at Laporte, Ind., as yet, may develop into an organized effort by the time the county council meets.

Information that in a number of Indiana counties the levy has been reduced, in deference to economic conditions and because of imperative needs for tax reduction, has brought the subject to attention here.

The gravel road levy has been 10c in this county for each year since 1925. For 1925 and the two years preceding it was 7c. In 1922 it was 13c and in 1921 it stood at 10c. Under the 1931 valuation a 10c levy will raise slightly more than $106,000, as the new county valuation is over $106,000,000. As this is more than the estimate of $103,000 made by Mack Howell, county highway superintendent, it will be possible to reduce the levy to 9.7c if the commissioners order it.

Receipts from the gravel road fund are used to maintain the county road system.

During the past few years the county highway department has been building several miles of resurfaced highway annually at a cost of between $6000 and $7000 a mile. This gives a hard surface to a former stone or macadam highway. Funds from the gravel road repair fund have been used for this purpose. Those who urge reduction of the levy claim this work could be discontinued temporarily.—*Michigan City* (Ind.) *News.*

Asks Greater Use of Cement in Oregon Bridges

L. C. NEWLANDS, vice-president and general manager of the Oregon Portland Cement Co., Oswego, Ore., is making a strong plea to the highway commission for greater use of cement in state bridges. He addressed a letter to the commission following active efforts of the lumber interests of the northwest to have wood products used in certain bridge construction.

"A concrete bridge more fully employs state materials than does a wooden bridge," Mr. Newlands stated, "inasmuch as it not only uses local cement, but it uses forms and supports in almost as large quantities as a wooden bridge, this wood being in general a type of lumber that is hard to market with profit in regular avenues of trade."

To substitute lumber for concrete would result in greatly increased unemployment in the cement industry that would not be absorbed in the lumber industry employment increase, even though some extra work would result.

Mr. Newlands expressed himself in agreement with the lumber industry that state-employed products should be used by the highway commission as far as this policy is consistent with economy and good construction, but he emphasized the desire to have the cement industry recognized.

Plans Study of Minerals in Alaska

THE DEPARTMENT of the Interior is conducting this summer in Alaska, an investigation to determine the mineral resources of that territory, the Department announces. The statement says the most significant effort yet made to determine the mineral values of Alaska will be carried out.

The recent congress appropriated $250,000 "for continuation of the investigation of mineral and other resources of Alaska," along the Alaska railroad. This is in addition to the regular appropriation for work in Alaska.

The appropriation was placed in the hands of Secretary Wilbur and he has organized the work chiefly through the Geological Survey.

To investigate, test, and report on nonmetallic minerals such as clay, limestone, marl, etc., in the railroad belt, and prepare a pamphlet on their economic value and possibilities of production, $5,000 has been set aside.

Geological Survey of Canada in 1931

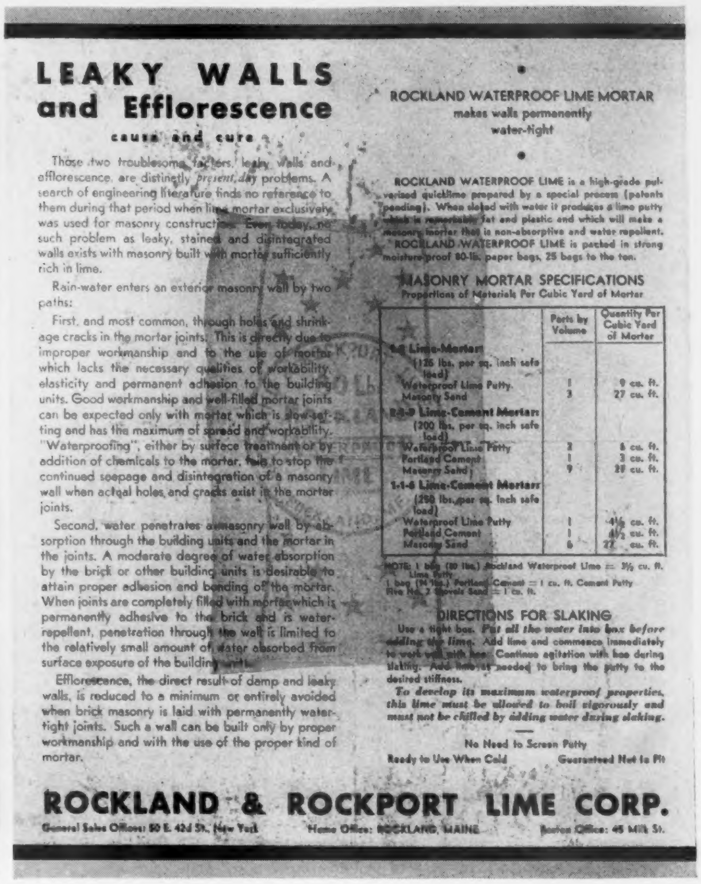
THE GEOLOGICAL SURVEY, Department of Mines, Ottawa, Canada, has 42 parties engaged in field work this year at different points throughout the country. Some 31 of these are engaged in economic and scientific investigations, while 11 are making topographical and geographical surveys to be used as a basis for future geological work, and as contributions to the systematic mapping of Canada. Work will be carried on in all the provinces and territories, with the exception of Prince Edward Island.

The more important features of the Survey's work this year are: An extensive survey of certain large areas underlain by pre-Cambrian formations in Northern Canada and Central Manitoba; a study of the Hillcrest coal field in Southern Alberta; the exploration of a large area of volcanic and sedimentary rocks in northwestern Quebec; a systematic investigation of the saline deposits in the vicinity of Moncton, N. B., and a geological survey of the Sydney coal field in Nova Scotia.—*Mining World and Engineering Record.*

Wire Rope Catalogue

A NEW GENERAL CATALOGUE has just been issued by John A. Roebling's Sons Co., Trenton, N. J., giving information on wire rope and other products manufactured by the company.

This 279-page illustrated catalogue covers wire rope of various kinds, rope attachments and accessories, electric wire and cables, etc., and also contains tables and general information on the use of wire rope.



LEAKY WALLS and Efflorescence

cause and cure

Those two troublesome factors, leaky walls and efflorescence, are distinctly *present-day* problems. A search of engineering literature finds no reference to them during that period when lime mortar exclusively was used for masonry construction. Even today, no such problem as leaky, stained and disintegrated walls exists with masonry built with mortar sufficiently rich in lime.

Rain-water enters an exterior masonry wall by two paths:

First, and most common, through holes and shrinkage cracks in the mortar joints. This is directly due to improper workmanship and to the use of mortar which lacks the necessary qualities of workability, elasticity and permanent adhesion to the building units. Good workmanship and well-filled mortar joints can be expected only with mortar which is slow-setting and has the maximum of spread and workability. "Waterproofing", either by surface treatment or by addition of chemicals to the mortar, fails to stop the continued seepage and disintegration of a masonry wall when actual holes and cracks exist in the mortar joints.

Second, water penetrates a masonry wall by absorption through the building units and the mortar in the joints. A moderate degree of water absorption by the brick or other building units is desirable to attain proper adhesion and bonding of the mortar. When joints are completely filled with mortar which is permanently adhesive to the brick and is water-repellent, penetration through the wall is limited to the relatively small amount of water absorbed from surface exposure of the building units.

Efflorescence, the direct result of damp and leaky walls, is reduced to a minimum or entirely avoided when brick masonry is laid with permanently water-tight joints. Such a wall can be built only by proper workmanship and with the use of the proper kind of mortar.

ROCKLAND WATERPROOF LIME MORTAR
makes walls permanently
water-tight

ROCKLAND WATERPROOF LIME is a high-grade pulverized quicklime prepared by a special process (patents pending). When slaked with water it produces a lime putty which is remarkably fat and plastic and which will make a masonry mortar that is non-absorptive and water repellent.

ROCKLAND WATERPROOF LIME is packed in strong moisture-proof 80-lb. paper bags, 25 bags to the ton.

MASONRY MORTAR SPECIFICATIONS
Proportions of Materials Per Cubic Yard of Mortar

	Parts by Volume	Quantity Per Cubic Yard of Mortar
1-3 Lime-Mortar (125 lbs. per sq. inch safe load)		
Waterproof Lime Putty	1	9 cu. ft.
Masonry Sand	3	27 cu. ft.
2-1-9 Lime-Cement Mortar (200 lbs. per sq. inch safe load)		
Waterproof Lime Putty	2	6 cu. ft.
Portland Cement	1	3 cu. ft.
Masonry Sand	9	27 cu. ft.
1-1-6 Lime-Cement Mortar (250 lbs. per sq. inch safe load)		
Waterproof Lime Putty	1	4½ cu. ft.
Portland Cement	1	4½ cu. ft.
Masonry Sand	6	27 cu. ft.

NOTE: 1 bag (80 lbs.) Rockland Waterproof Lime = 3½ cu. ft. Lime Putty
1 bag (94 lbs.) Portland Cement = 1 cu. ft. Cement Putty
Five No. 2 Shovels Sand = 1 cu. ft.

DIRECTIONS FOR SLAKING

Use a tight box. *Put all the water into box before adding the lime.* Add lime and commence immediately to work well with hoe. Continue agitation with hoe during slaking. Add lime as needed to bring the putty to the desired stiffness.

To develop its maximum waterproof properties, this lime must be allowed to boil vigorously and must not be chilled by adding water during slaking.

No Need to Screen Putty
Ready to Use When Cold — Guaranteed Not to Pit

ROCKLAND & ROCKPORT LIME CORP.
General Sales Offices: 50 E. 42d St., New York — Home Office: ROCKLAND, MAINE — Boston Office: 45 Milk St.

Advertising matter used to describe new product

Develops Lime Mortar Market with New Product

ALERT to the possibilities available and with determination to benefit through aggressive promotion, the Rockland & Rockport Lime Corp., Rockland, Me., has recently introduced a new product known as "Rockland Waterproof Lime," for which patent is pending.

This lime is described as a high-grade pulverized quicklime prepared by a special process. When slaked with water it is said to produce a lime putty which is remarkably fat and plastic and which will make a masonry mortar that is non-absorptive and water repellent. It is packed in 80-lb. moisture-proof paper bags.

The introduction of this product is particularly timely, coming as it does at a time when the building industry is directing particular attention to the question of masonry mortars, and also following the inauguration of concentrated effort of the National Lime Association to win back the masonry mortar market.

Accompanying illustrations reproduce a folder that has been issued by the Rockland company describing this product and which forms a part of the promotional effort to regain a market.

The general sales office of the Rockland & Rockport Lime Corp., is at 50 East 42nd Street, New York City. The home office is at Rockland, Maine.

New Interests in California Lime Plant—May Make Cement

REORGANIZATION of the Cajon Lime Products Co. and reopening of that concern's plant and quarry in Cajon pass about 15 mi. northwest of San Bernardino, Calif., are planned by new interests who have acquired control of the holdings and obtained their release from receivership. Plans for renewal of operations of the lime plant, and of intended expansion to include cement manufacture, became known recently in connection with release of the Cajon Lime Products Co. from receivership, by Russell W. MacGillivray of San Bernardino.

Loren Foreman, senior partner of the nationally known firm of Foreman and Clark, is said to have acquired control of the Cajon company. It is reported from reliable sources that Mr. Foreman and a group of associates will commence operation of the plant and quarry sometime in the early fall, probably in September.

Plans for reopening of the plant and for expansion of its plant and quarry are said to call for start of operations limited to manufacture of lime, with development of cement mills slated to follow when the lime business is well established.

Barney Bricker, Riverside financier, and an eastern capitalist are said to have owned controlling interest in the company prior to the reported action of Mr. Foreman and associates in purchasing control and planning renewal of operation. The company owns considerable acreage in Cajon pass, besides having extensive government leases on other land adjacent to its own property.—*San Bernardino* (Calif.) *Telegram.*

Open Lime Kilns in Arizona

TUCSON, Ariz., has added a new industry to its growing list with the formal opening of the New Process Lime Co., by Frank R. Rendon and associates recently.

The new company, with an investment of more than $15,000 in machinery, buildings and equipment, will produce building lime for the local and surrounding markets, and will be the only plant of its kind in this vicinity.

Associated with Frank R. Rendon in the enterprise are Angelo Guadagnoli and Gabe Rendon.

Frank R. Rendon, president of the company, is well known in Tucson, having been born and raised there. He became interested in the lime business in 1925 and established a kiln at Globe, Ariz., which he still operates.

Gabe Rendon will take an active part in the Tucson enterprise in both the production and sales departments.

The new plant includes a lime kiln, hoist house, warehouse and office, and is designed to produce 15 tons of lime daily.

The lime quarry is located 7 mi. west of Tucson.—*Tucson* (Ariz.) *Star.*

Output of Portland Cement in 1930

Final Government Figures Show Decrease of 6% from 1929, and Nearly 9% from 1928

STATISTICS relating to the portland cement industry in 1930 compiled by the United States Bureau of Mines, department of Commerce, from the final returns of the producers for the year confirm the estimates published by the Bureau of Mines early in January.

Production of portland cement in 1930—161,197,228 bbl.—showed a decrease of 6% from 1929, and of nearly 9% from 1928, the highest year of production.

Shipments of portland cement from mills in 1930 amounted to 159,059,334 bbl. valued at $228,719,756, a decrease of 6% in quantity and of more than 9% in gross value. The average factory price per bbl. in bulk in 1930 was $1.44, a decrease of 4c. per bbl. as compared with 1929.

Largest Stocks on Hand

Producers' stocks on hand at the mills increased, reaching a total of 25,838,427 bbl. on December 31, 1930. They were 9% higher than at the end of 1929, and represented the largest stocks on hand at the end of any year since the beginning of the official statistical record of this item.

From the reports of the producers showing mill shipments of portland cement into the various states, estimates of per capita consumption in the accompanying table have been compiled. These are at best but approximations as they represent only the records of mill shipments into states; they do not include the imports, which would increase the consumption in certain states near the Canadian border and the seaboard, nor do they make allowance for a variable but considerable stocks of cement at all times in transit, in warehouses at distributing points, and awaiting use at jobs.

The commercial capacity for production of finished portland cement of the 163 plants active at the end of 1930, and of three plants idle in 1930 but producing within the three previous years, according to manufacturers' reports supplemented by a few estimates, was 270,044,000 bbl. This total includes increased capacity due to extensions and im-

PORTLAND CEMENT MANUFACTURING CAPACITY OF THE UNITED STATES, BY COMMERCIAL DISTRICTS, 1929 AND 1930

District	Estimated capacity (barrels) 1929	Estimated capacity (barrels) 1930	Percentage of capacity utilized 1929	Percentage of capacity utilized 1930
Eastern Pennsylvania, New Jersey, and Maryland	53,983,000	56,019,000	69.9	62.7
New York and Maine	18,449,000	19,009,000	61.9	59.7
Ohio, western Pennsylvania and West Virginia	26,400,000	28,652,000	67.9	61.5
Michigan	18,535,000	19,241,000	74.2	59.8
Wisconsin, Illinois, Indiana, and Kentucky	29,293,000	31,393,000	73.0	64.4
Virginia, Tennessee, Alabama, Georgia, Florida, and Louisiana	25,034,000	26,491,000	55.1	48.6
Eastern Missouri, Iowa, Minnesota, and South Dakota	22,661,000	24,242,000	69.3	68.9
Western Missouri, Nebraska, Kansas, Oklahoma, and Arkansas	17,136,000	17,883,000	72.3	70.0
Texas	9,950,000	10,359,000	74.1	65.5
Colorado, Montana, Utah, Wyoming, and Idaho	6,669,000	6,769,000	40.4	33.5
California	23,350,000	22,405,000	56.1	45.2
Oregon and Washington	7,457,000	7,581,000	45.5	54.0
	258,917,000	270,044,000	65.9	59.7

PORTLAND CEMENT PRODUCED, SHIPPED, AND IN STOCK IN THE UNITED STATES, 1929 AND 1930, BY STATES

			Production			Shipments							Stock (Dec. 31)		
State	Active plants 1929	Active plants 1930	Barrels 1929	Barrels 1930	Increase or decrease 1930 (per cent.)	1929 Barrels	1929 Value	1930 Barrels	1930 Value	Average factory value per barrel 1929	Average factory value per barrel 1930	Increase or decrease in quantity 1930 (per cent.)	Barrels 1929 (revised)	Barrels 1930	Increase or decrease 1930 (per cent.)
Alabama	6	6	5,005,967	4,821,141	— 4	5,228,947	$ 5,911,031	4,689,516	$ 5,829,818	$1.13	$1.24	—10	522,058	653,683	+25
California	12	12	13,091,899	10,124,219	—23	12,964,746	22,805,576	[illegible]	15,241,089	1.76	1.46	—19	1,077,385	763,125	—29
Illinois	4	4	8,242,725	7,934,563	— 4	7,738,208	11,134,538	7,951,680	10,519,162	1.44	1.32	+ 3	1,201,958	1,184,841	— 1
Iowa	6	6	6,373,330	7,088,108	+11	6,586,111	9,781,159	7,035,252	10,047,584	1.49	1.43	+ 7	1,347,144	1,400,000	+ 4
Kansas	7	7	6,739,741	6,012,360	—11	6,855,861	10,041,282	5,633,098	8,254,416	1.46	1.47	—18	795,512	1,174,774	+48
Michigan	14	14	13,748,862	11,510,895	—16	13,325,727	18,916,711	10,817,994	14,897,439	1.42	1.38	—19	2,403,185	3,096,086	+29
Missouri	5	5	8,113,304	7,808,543	— 4	7,984,337	11,557,905	8,030,528	11,470,751	1.45	1.43	+ 0.6	1,025,837	803,852	—22
New York	10	10	10,761,368	10,372,742	— 4	10,742,992	15,597,868	10,256,086	15,380,703	1.45	1.50	— 5	1,523,266	1,639,922	+ 8
Ohio	10	10	9,427,084	8,632,062	— 8	9,144,085	13,427,778	8,185,077	11,956,038	1.47	1.46	—10	1,357,074	1,804,059	+33
Pennsylvania	27	27	39,354,470	37,843,662	— 4	39,309,662	55,600,953	37,968,647	52,712,176	1.41	1.39	— 3	6,010,685	5,885,700	— 2
Tennessee	6	6	4,442,249	3,874,549	—13	4,537,601	5,576,235	3,822,598	5,315,693	1.23	1.39	—16	475,566	527,517	+11
Texas	9	9	7,374,428	6,781,502	— 8	7,083,572	11,805,779	6,792,346	10,782,444	1.67	1.59	— 4	812,771	801,927	— 1
Other states*	47	47	37,970,609	38,392,882	+ 1	38,366,473	59,996,974	37,438,033	56,312,443	1.56	1.50	— 2	5,148,092	6,102,941	+19
	163	163	170,646,036	161,197,228	— 6	169,868,322	$252,153,789	159,059,334	$228,719,756	$1.48	$1.44	— 6	23,700,533	25,838,427	+ 9

*Includes Arkansas, Colorado, Florida, Georgia, Idaho, Indiana, Kentucky, Louisiana, Maine, Maryland, Minnesota, Montana, Nebraska, New Jersey, Oklahoma, Oregon, South Dakota, Utah, Virginia, Washington, West Virginia, Wisconsin, and Wyoming.

PORTLAND CEMENT PRODUCED, SHIPPED, AND IN STOCK IN THE UNITED STATES, 1929 AND 1930, BY DISTRICTS

			Production			Shipments							Stock (Dec. 31)		
State	Active plants 1929	Active plants 1930	Barrels 1929	Barrels 1930	Increase or decrease 1930 (per cent.)	1929 Barrels	1929 Value	1930 Barrels	1930 Value	Average factory value per barrel 1929	Average factory value per barrel 1930	Increase or decrease in quantity 1930 (per cent.)	Barrels 1929 (revised)	Barrels 1930	Increase or decrease 1930 (per cent.)
Eastern Penn., N. J. and Maryland	25	25	27,726,967	35,140,880	— 7	37,647,014	$52,042,469	35,356,917	$49,041,368	$1.41	$1.39	— 6	5,251,826	5,035,789	— 4
New York and Maine	11	11	11,418,596	11,341,724	— 7	11,519,619	16,780,423	11,121,958	16,877,560	1.46	1.52	— 3	1,554,615	1,774,381	+14
Ohio, Western Penn. and West Virginia	19	19	17,936,179	17,620,488	— 2	17,737,226	25,922,200	17,068,119	24,395,914	1.46	1.43	— 4	3,034,638	3,587,007	+18
Michigan	14	14	13,748,862	11,510,895	—16	13,325,727	18,916,711	10,817,994	14,897,439	1.42	1.38	—19	2,403,185	3,096,086	+29
Wis., Ill., Ind., Ky.	11	11	21,378,418	20,232,671	— 5	21,171,227	31,168,394	19,571,759	26,995,982	1.47	1.38	— 8	2,942,727	3,603,639	+22
Va., Tenn., Ala., Ga., Fla. and La.	19	19	13,792,618	12,880,818	— 7	14,047,259	17,689,012	12,728,652	17,664,733	1.26	1.39	— 9	1,642,359	1,794,525	+ 9
East'n Missouri, Iowa, Minn. and S. Dak.	12	12	15,697,414	16,693,905	+ 6	15,984,176	23,430,891	16,886,039	24,001,001	1.47	1.42	+ 6	2,595,251	2,403,117	— 7
West'n Missouri, Neb., Kan., Okla., Ark.	13	13	12,392,722	12,510,599	+ 1	12,267,352	18,124,275	11,880,424	17,704,859	1.48	1.49	— 3	1,459,130	2,089,305	+43
Texas	9	9	7,374,428	6,781,502	— 8	7,083,572	11,805,779	6,792,346	10,782,444	1.67	1.59	— 4	812,771	801,927	— 1
Colo., Mont., Utah, Wyo. and Idaho	9	9	2,695,024	2,268,813	—16	2,766,167	5,764,757	2,375,335	4,657,623	2.08	1.96	—14	459,822	353,300	—23
California	12	12	13,091,899	10,124,219	—23	12,964,746	22,805,576	10,438,479	15,241,089	1.76	1.46	—19	1,077,385	763,125	—29
Oregon and Wash.	9	9	3,392,909	4,090,714	+21	3,354,237	6,703,302	4,021,312	6,459,744	2.00	1.61	+20	466,824	536,226	+15
	163	163	170,646,036	161,197,228	— 6	169,868,322	$252,153,789	159,059,334	$228,719,756	$1.48	$1.44	— 6	23,700,533	25,838,427	+ 9

provements at old plants. There were no new plants reported as entering production in 1930. The capacity of one plant reported out of business in 1930 and idle in that year and in the two previous years, has been excluded from the figures for 1930. The total production for 1930 was 59.7% of the indicated capacity at the close of the year; the corresponding figure for 1929 is 65.9%.

A summary of the monthly estimates of output of portland cement in 1930, compiled from monthly reports of the producers, was published early in January, 1931, by the Bureau of Mines. These estimates, which indicated a production of 160,905,000 bbl. and shipments of about 158,744,000 bbl., were within 0.2% each of the figures for 1930.

In addition to the imports shown in the accompanying tables there are also reported "imported for consumption, white nonstaining portland cement": in 1929, 25,072 bbl., valued at $54,045; in 1930, 9,261 bbl., valued at $18,749.

SHIPMENTS OF DOMESTIC PORTLAND CEMENT FROM MILLS INTO STATES AND PER CAPITA, 1929 AND 1930, IN BARRELS*

State	1929 Total	1929 Per capita*	1930 Total	1930 Per capita*
Alabama	1,958,089	0.76	1,273,632	0.48
Arizona†	656,775	1.39	462,560	1.06
Arkansas	1,555,517	.80	1,459,388	.79
California	11,802,278	2.59	9,426,837	1.66
Colorado	891,973	.82	843,983	.81
Connecticut†	1,908,868	1.15	1,754,324	1.09
Delaware†	365,257	1.50	373,672	1.57
District of Columbia†	1,126,946	2.04	1,078,729	2.22
Florida	1,176,495	.83	1,056,549	.72
Georgia	1,423,359	.44	1,561,775	.54
Idaho	261,378	.48	311,800	.70
Illinois	13,490,520	1.82	11,164,248	1.46
Indiana	5,674,739	1.79	4,927,894	1.52
Iowa	5,462,534	2.25	6,411,595	2.59
Kansas	2,605,330	1.42	2,398,123	1.27
Kentucky	1,575,715	.62	1,695,202	.65
Louisiana	1,657,154	.85	2,892,404	1.38
Maine	600,423	.76	835,795	1.05
Maryland	2,426,107	1.50	2,555,386	1.57
Massachusetts†	2,908,230	.68	3,090,962	.73
Michigan	11,686,635	2.55	8,625,691	1.78
Minnesota	3,212,554	1.18	3,668,645	1.43
Mississippi†	1,028,561	.57	619,649	.31
Missouri	5,620,624	1.60	6,145,380	1.69
Montana	552,357	1.01	319,214	.59
Nebraska	1,470,294	1.04	1,675,904	1.22
Nevada†	133,132	1.72	147,243	1.62
New Hamp.†	665,519	1.46	559,958	1.20
New Jersey	8,015,348	2.10	6,536,136	1.62
New Mexico†	286,473	.72	298,111	.70
New York	21,039,518	1.82	20,147,426	1.60
North Carolina†	1,753,324	.60	1,165,162	.37
North Dakota†	444,798	.69	337,888	.50
Ohio	10,033,158	1.47	9,698,510	1.46
Oklahoma	3,352,328	1.38	3,396,549	1.42
Oregon	1,017,434	1.13	1,070,341	1.12
Pennsylvania	13,135,444	1.33	13,795,600	1.43
Rhode Island†	721,352	1.01	704,943	1.03
South Carolina†	1,190,008	.64	1,654,951	.95
South Dakota	530,455	.75	540,867	.78
Tennessee	2,934,953	1.17	2,410,519	.92
Texas	7,584,278	1.38	6,417,951	1.10
Utah	521,047	.98	417,472	.82
Vermont†	928,881	2.64	582,495	1.62
Virginia	1,764,760	.69	1,648,052	.68
Washington	2,477,520	1.56	3,102,088	1.98
West Virginia	1,415,161	.82	1,598,843	.92
Wisconsin	5,517,598	1.87	4,974,591	1.69
Wyoming	192,995	.78	178,873	.79
Unspecified	....	......	15,865	......
	168,754,196	1.41	158,029,775	1.29
Exports reported by manufacturers but not included above§	1,114,126	......	1,029,559	......
Total shipped from cement plants	169,868.322	......	159,059,334	......

*Per capita figures based on latest available estimates of population made by the Bureau of the Census.

†Noncement-producing state.

§Includes shipments to Alaska, Hawaii and Porto Rico.

EXPORTS* OF HYDRAULIC CEMENT BY COUNTRIES IN 1929 AND 1930

Exported to	Barrels—1929	Value—1929	Barrels—1930	Value—1930
Canada	60,172	$ 273,079	51,367	$ 204.913
Central America	143,059	353,234	176,397	436,015
Cuba	102,257	247,876	66,258	168,345
Other West Indies and Bermuda	67,271	173,480	53,017	116,064
Mexico	174,208	531,982	126,803	370,612
South America	274,393	1,120,543	233,593	877,434
Other countries	63,961	383,023	48,343	281,132
	885,321	$3,083,217	755,778	$2,454,515

*The value of exports of domestic cement is the actual cost at the time of exportation in the ports of the United States whence they are exported, as declared by the shippers on the export declarations.

DOMESTIC HYDRAULIC CEMENT SHIPPED TO ALASKA, HAWAII, AND PORTO RICO IN 1929 AND 1930†

	Barrels—1929	Value—1929	Barrels—1930	Value—1930
Alaska	17,906	$ 54,052	23,957	$ 63,970
Hawaii	289,040	687,904	266,990	679,756
Porto Rico	45,397	105,325	54,193	100,547
	352,343	$847,281	345,140	$844,273

†Compiled from records of the Bureau of Foreign and Domestic Commerce.

IMPORTS* OF HYDRAULIC CEMENT IN 1929 AND 1930, BY DISTRICTS‡

District	Barrels—1929	Value—1929	Barrels—1930	Value—1930
Alaska	48	$ 218	....	....
Connecticut	3,000	3,094	....	....
Duluth-Superior	9	23	....	....
Florida	15,750	17,188	3,450	$ 3,828
Galveston	14,400	21,297	....	....
Hawaii	100	212	11,344	13,761
Los Angeles	494,618	300,868	155,234	120,153
Maine and New Hampshire	5,740	12,997	2,190	5,820
Maryland	3,489	7,000	180	213
Massachusetts	280,501	351,131	216,490	274,235
New Orleans	36.473	45,102	4,700	5,620
New York	312,978	430,289	202,897	232,999
North Carolina	38,495	47,879	....	....
Oregon	34,461	41,968	3,000	3,588
Philadelphia	71,333	97,200	155,047	178,401
Porto Rico	278,214	391,166	214,549	290,344
Rhode Island	35,750	45,105	....	....
Sabine	5,500	8,988	....	....
San Antonio	19,432	20,825	6,300	6,429
San Francisco	9,091	11,589	127	326
South Carolina	63,245	77,899	....	....
Vermont	6	15	38	96
Virginia	3,017	3,280	....	....
Washington	2,250	2,907	....	....
	1,727,900	$1,938,240	975,546	$1,135,813

*The value of imported cement represents the foreign market value at the time of exportation to the United States.

‡Compiled from records of the Bureau of Foreign and Domestic Commerce.

IMPORTS OF HYDRAULIC CEMENT BY COUNTRIES AND BY DISTRICTS, IN 1930

Imported from	District into which imported	Barrels	Value
Belgium	Florida	3,450	$ 3,828
	Los Angeles	143,647	93,645
	Maryland	155	174
	Massachusetts	212,935	266,178
	New Orleans	4,700	5,620
	New York	29,630	32,639
	Oregon	3,000	3,588
	Philadelphia	29,418	40,463
	Porto Rico	13,501	19,481
	San Antonio	6,300	6,429
	Total	446,736	$472,045
Canada	Me. and N. H.	2,190	$5,820
	Porto Rico	9,708	12,086
	Vermont	38	96
	Total	11,936	$18,002
Denmark	New York	92,117	$93,077
	Porto Rico	191,340	258,777
	Total	283,457	$351,854
France	Massachusetts	3,555	$8,057
	New York	5,982	11,654
	Total	9,537	$19,711
Germany	Los Angeles	11.089	$24,308
	New York	19	72
	San Francisco	127	326
	Total	11,235	$24,706
Italy	New York	10	$22
Japan	Hawaii	11,344	$13,761
Norway	Maryland	25	$39
United K'gd'm.	Los Angeles	498	$2,200
	New York	75,139	95,535
	Philadelphia	125,629	137,938
	Total	201,266	$235,673
	Grand total	975,546	$1,135,813

Tennessee Highway Department Buys Cement Made Locally

CLAIMING that recommendations of the Hoover emergency commission in regard to favoring local industry has been carried out as far as possible, the Tennessee State Purchasing Department recently sent out contracts to five Tennessee cement mills ordering approximately 81,000 bbl. of cement to be used in highway construction.

According to Commissioner R. H. Baker of the Highway Department, who authorized the purchase, a price 3 c. per bbl. under the low bidder at a recent letting was guaranteed by the Tennessee manufacturers, and the state saved approximately $20,000.

Bids were sought several weeks ago and rejected following a general decline in cement prices of approximately 5 c. per bbl. When new bids were opened recently it was found that the Marquette Cement Manufacturing Co. was low bidder. The five Tennessee mills—two at Chattanooga, two at Nashville and one at Kingsport—asked that they be permitted to guarantee a price 3 c. a barrel less, claiming that their plants were being operated on part time, and urging that this business come to Tennessee mills.

This plan was agreed upon and the order placed.—*Nashville* (Tenn.) *Banner*.

Portland Cement Production for July

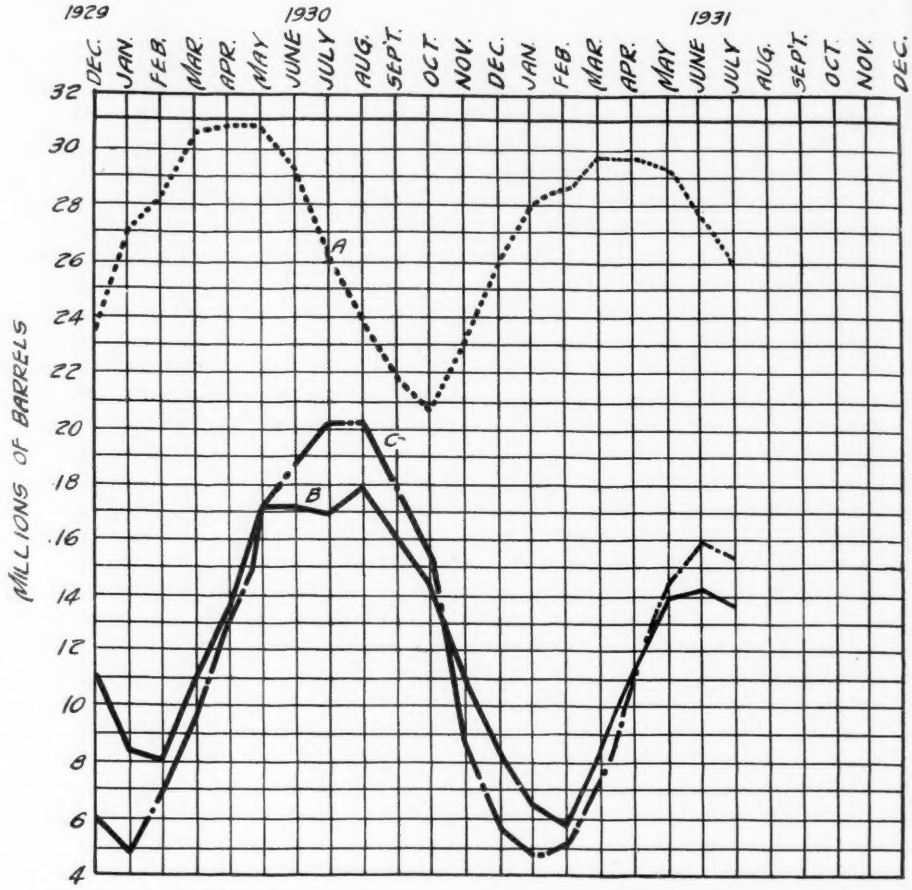
THE PORTLAND CEMENT INDUSTRY, in July, 1931, produced 13,899,000 bbl., shipped 15,545,000 bbl. from the mills, and had in stock at the end of the month 25,957,000 bbl. Production of portland cement in July, 1931, showed a decrease of 18.6% and shipments a decrease of 22.9% as compared with July, 1930. Portland cement stocks at the mills were 1.3% lower than a year ago.

The statistics here presented are compiled from reports for July, received by the Bureau of Mines, from all manufacturing plants except three, for which estimates have been included in lieu of actual returns.

In the following statement of relation of production to capacity the total output of finished cement is compared with the estimated capacity of 165 plants at the close of July, 1931, and of 166 plants at the close of July, 1930. The estimates include increased capacity due to extensions and improvements during the period.

RELATION OF PRODUCTION TO CAPACITY

	July 1930 Pct.	July 1931 Pct.	June 1931 Pct.	May 1931 Pct.	Apr. 1931 Pct.
The month	77.8	62.0	65.4	62.8	52.1
12 months ended	66.1	53.8	55.2	56.5	57.7



(A) Stocks of finished portland cement at factories; (B) Production of finished portland cement; (C) Shipments of finished portland cement from factories

PRODUCTION, SHIPMENTS, AND STOCKS OF FINISHED PORTLAND CEMENT, BY DISTRICTS, IN JULY, 1930 AND 1931, AND STOCKS IN JUNE, 1931, IN BARRELS

District	Production 1930—July	Production —1931	Shipments 1930—July	Shipments —1931	Stocks at end of month 1930	Stocks at end of month 1931	Stocks at end of June, 1931*
Eastern Penn., N. J., Md.	3,566,000	2,675,000	4,085,000	3,114,000	5,992,000	6,026,000	6,465,000
New York and Maine	1,249,000	1,192,000	1,524,000	1,436,000	1,462,000	1,670,000	1,914,000
Ohio, Western Penn., W. Va.	1,973,000	1,520,000	2,358,000	1,471,000	3,523,000	3,559,000	3,511,000
Michigan	1,410,000	983,000	1,604,000	1,147,000	2,618,000	2,208,000	2,372,000
Wis., Ill., Ind. and Ky.	2,255,000	1,877,000	2,916,000	2,275,000	3,931,000	3,518,000	3,915,000
Va., Tenn., Ala., Ga., Fla., La.	1,213,000	1,319,000	1,327,000	1,210,000	1,889,000	1,588,000	1,479,000
East'n Mo., Ia., Minn., S. D.	1,832,000	1,414,000	2,540,000	1,896,000	2,495,000	2,762,000	3,244,000
West'n Mo., Neb., Kansas, Okla. and Ark.	1,405,000	1,015,000	1,442,000	1,102,000	1,688,000	1,624,000	1,710,000
Texas	585,000	646,000	709,000	696,000	564,000	626,000	675,000
Colo., Mont., Utah, Wyo., Ida.	217,000	219,000	276,000	229,000	501,000	619,000	629,000
California	1,009,000	670,000	946,000	624,000	1,144,000	1,158,000	1,113,000
Oregon and Washington	364,000	369,000	426,000	345,000	482,000	599,000	575,000
	17,078,000	13,899,000	20,153,000	15,545,000	26,289,000	25,957,000	27,602,000

PRODUCTION, SHIPMENTS AND STOCKS OF FINISHED PORTLAND CEMENT, BY MONTHS, IN 1930 AND 1931, IN BARRELS

Month	1930—Production	—1931	1930—Shipments	—1931	Stocks at end of month 1930	Stocks at end of month 1931
January	8,498,000	6,595,000	4,955,000	4,692,000	27,081,000	27,759,000
February	8,162,000	5,920,000	7,012,000	5,074,000	28,249,000	28,612,000
March	11,225,000	8,245,000	8,826,000	7,192,000	30,648,000	29,676,000
April	13,521,000	11,245,000	13,340,000	11,184,000	30,867,000	29,715,000
May	17,249,000	14,010,000	17,224,000	14,200,000	30,891,000	29,554,000
June	17,239,000	*14,118,000	18,781,000	*16,077,000	29,364,000	*27,602,000
July	17,078,000	13,899,000	20,153,000	15,545,000	26,289,000	25,957,000
August	17,821,000	....	20,299,000	....	23,824,000	....
September	16,124,000	....	18,083,000	....	21,889,000	....
October	14,410,000	....	15,599,000	....	20,697,000	....
November	11,098,000	....	8,784,000	....	23,056,000	....
December	8,480,000	....	5,688,000	....	*25,838,000	....
	160,905,000	....	158,744,000	....	....	....

Distribution of Cement

Figures on opposite page show shipments from cement mills distributed among the states to which cement was shipped during May and June, 1930 and 1931 and in the first six months of 1930 and 1931.

Exports and Imports

Compiled from the records of the Bureau of Foreign and Domestic Commerce and subject to revision.

EXPORTS OF HYDRAULIC CEMENT BY COUNTRIES IN JUNE, 1931

Exported to—	Barrels	Value
Canada	3,836	$ 15,270
Central America	1,847	5,573
Cuba	5,314	12,772
Other West Indies and Bermuda	2,339	3,963
Mexico	3,088	9,865
South America	25,457	50,155
Other countries	1,738	10,379
	43,619	$107,977

IMPORTS OF HYDRAULIC CEMENT BY COUNTRIES AND BY DISTRICTS, IN JUNE, 1931

Imported from	District into which imported	Barrels	Value
Belgium	Porto Rico	3,638	$ 5,530
Canada	Maine and New Hampshire	58	148
Denmark	Porto Rico	5,536	4,188
Japan	Hawaii	1,848	2,219
United Kingdom	New York	21,000	30,870
Total		32,080	$42,955

PRODUCTION AND STOCKS OF CLINKER BY MONTHS, IN 1930 AND 1931, IN BARRELS

Month	1930—Production	—1931	Stocks at end of month 1930	Stocks at end of month 1931
January	10,504,000	8,129,000	9,646,000	10,384,000
February	10,008,000	7,473,000	11,572,000	11,946,000
March	13,045,000	9,586,000	13,503,000	13,318,000
April	15,025,000	11,540,000	15,164,000	13,854,000
May	16,607,000	13,159,000	14,668,000	13,087,000
June	15,895,000	*12,679,000	13,452,000	*11,837,000
July	15,069,000	12,246,000	11,684,000	10,342,000
August	15,244,000	....	9,275,000	....
September	14,577,000	....	7,783,000	....
October	13,895,000	....	7,266,000	....
November	11,639,000	....	7,758,000	....
December	9,484,000	....	8,809,000	....

*Revised.

PORTLAND CEMENT SHIPPED FROM MILLS INTO STATES IN MAY AND JUNE, 1930 AND 1931, AND IN THE FIRST SIX MONTHS OF 1930 AND 1931, IN BARRELS*

Shipped to	1930—May	—1931	1930—June	—1931	First six months 1930	First six months 1931
Alabama	129,594	183,572	124,375	138,369	726,954	909,543
Alaska	2,068	946	2,961	1,100	10,603	4,480
Arizona	41,429	42,634	41,057	41,110	257,219	257,497
Arkansas	131,701	187,370	175,644	177,846	648,214	721,294
California	876,467	628,900	†843,231	646,220	4,517,716	3,733,806
Colorado	109,098	124,139	110,203	99,511	420,650	390,118
Connecticut	211,543	176,666	191,348	166,357	820,234	657,033
Delaware	38,168	47,276	59,042	51,926	178,160	173,013
District of Columbia	96,091	130,588	80,561	141,277	423,687	577,598
Florida	104,418	82,852	89,285	95,649	560,276	414,132
Georgia	135,715	156,532	142,722	183,317	698,344	839,179
Hawaii	29,558	25,580	15,182	22,996	146,956	147,263
Idaho	22,081	19,917	31,356	25,547	109,920	95,367
Illinois	1,038,904	882,739	1,212,319	1,069,134	3,863,590	3,371,090
Indiana	637,605	411,373	820,836	616,508	2,331,132	1,603,603
Iowa	1,067,232	611,996	1,126,961	779,351	2,905,182	1,926,479
Kansas	270,178	328,414	245,344	300,175	1,215,286	1,129,098
Kentucky	122,507	231,958	115,398	215,082	536,385	871,819
Louisiana	311,868	314,748	306,306	422,388	1,738,636	1,520,723
Maine	79,871	54,690	89,475	90,276	296,286	217,891
Maryland	331,582	199,360	267,222	230,317	1,210,808	834,944
Massachusetts	325,910	323,576	286,925	318,456	1,318,607	1,248,665
Michigan	1,022,121	659,977	1,164,439	842,129	3,592,233	2,443,326
Minnesota	501,896	468,010	627,906	625,439	1,639,111	1,578,769
Mississippi	44,775	82,827	51,847	82,243	296,822	316,999
Missouri	734,806	511,513	727,279	500,949	2,577,754	1,990,424
Montana	37,558	30,139	42,565	35,590	154,673	129,402
Nebraska	164,983	237,284	235,023	272,654	730,258	764,987
Nevada	15,133	10,999	16,830	11,041	73,281	52,252
New Hampshire	66,250	42,169	75,978	43,410	226,995	142,276
New Jersey	712,665	557,649	763,411	508,242	3,066,239	2,123,201
New Mexico	32,693	42,604	30,382	29,840	149,694	154,113
New York	2,032,025	2,013,197	2,331,986	2,498,158	8,360,660	8,351,021
North Carolina	133,974	146,249	111,543	163,922	629,599	599,236
North Dakota	43,316	43,024	63,127	55,251	179,344	159,594
Ohio	1,091,994	668,196	1,119,351	817,720	4,107,329	2,694,684
Oklahoma	364,053	301,925	353,241	290,304	1,716,653	1,213,929
Oregon	89,175	104,620	99,177	109,997	455,272	479,663
Pennsylvania	1,559,467	801,763	1,793,487	866,697	6,073,222	3,492,133
Porto Rico	5,265	3,905	250	17,385	12,440	28,427
Rhode Island	87,710	81,320	75,394	66,438	322,528	271,706
South Carolina	80,910	256,625	83,713	224,825	402,640	1,309,654
South Dakota	51,745	77,241	73,344	110,088	232,288	300,568
Tennessee	229,121	158,104	284,045	162,661	1,088,879	685,249
Texas	583,004	597,840	630,469	586,255	3,353,396	2,774,537
Utah	54,023	30,513	47,830	43,516	230,565	153,814
Vermont	55,676	24,529	72,329	42,905	219,815	102,097
Virginia	182,283	183,752	156,599	193,085	776,233	800,686
Washington	324,551	276,386	347,994	226,264	1,335,829	1,128,786
West Virginia	175,547	128,383	174,962	184,176	657,191	584,668
Wisconsin	564,324	431,564	751,985	569,655	1,991,707	1,561,114
Wyoming	18,818	17,243	25,877	19,781	79,479	69,716
Unspecified	13,660	12,082	5,268	1,246	100,194	138,917
	17,187,109	14,167,458	†18,715,384	16,034,778	69,767,168	58,240,583
Foreign countries	36,891	32,542	†65,616	42,222	370,832	178,417
Total shipped from cement plar*s	17,224,000	14,200,000	18,781,000	†16,077,000	70,138,000	58,419,000

*Includes estimated distribution of shipments from two plants each month in 1930; from three plants in January, May ard June, 1931; from tour plants in February, March and April, 1931. †Revised.

PRODUCTION AND STOCKS OF CLINKER (UNGROUND CEMENT), BY DISTRICTS, IN JULY, 1930 AND 1931, IN BARRELS

District	1930—Production	—1931	Stocks at end of month 1930	Stocks at end of month 1931
Eastern Pennsylvania, New Jersey and Maryland	3,211,000	2,537,000	1,962,000	1,593,000
New York and Maine	1,124,000	1,047,000	740,000	1,083,000
Ohio, Western Pennsylvania, and West Virginia	1,667,000	1,339,000	1,432,000	1,263,000
Michigan	1,138,000	610,000	1,351,000	1,048,000
Wisconsin, Illinois, Indiana and Kentucky	1,854,000	1,574,000	1,922,000	1,199,000
Virginia, Tennessee, Alabama, Georgia, Florida, Louisiana	1,152,000	1,281,000	928,000	685,000
Eastern Missouri, Iowa, Minnesota and South Dakota	1,606,000	1,159,000	836,000	710,000
Western Missouri, Nebraska, Kansas, Oklahoma, Arkansas	1,330,000	935,000	354,000	622,000
Texas	550,000	675,000	286,000	310,000
Colorado, Montana, Utah, Wyoming and Idaho	241,000	212,000	229,000	275,000
California	891,000	588,000	1,109,000	1,290,000
Oregon and Washington	305,000	289,000	535,000	264,000
	15,069,000	12,246,000	11,684,000	10,342,000

EXPORTS AND IMPORTS OF HYDRAULIC CEMENT. BY MONTHS. IN 1930 AND 1931

Month	1930—Exports Barrels	1930 Value	—1931 Barrels	1931 Value	1930—Imports Barrels	1930 Value	—1931§ Barrels	1931 Value
January	82,387	$293,135	41,199	$115,678	201,609	$207,461	97,057	$132,937
February	64,267	217,798	25,703	88,989	114,455	119,717	22,370	26,250
March	117,563	357,896	54,599	144,579	43,622	59,981	70,532	80,686
April	57,419	200,217	40,478	116,564	140,871	178,226	54,717	61,728
May	57,423	198,170	48,028	140,953	94,696	111,998	20,061	22,794
June	82,077	223,639	43,619	107,977	55,356	74,370	32,080	42,955
July	47,082	166,577	....	....	12,404	20,973	....	....
August	49,031	167,579	....	....	35,323	39,029	....	....
September	46,664	153,384	....	....	51,096	59,721	....	....
October	6[illegible],690	190,305	....	....	75,284	84,364	....	....
November	5[illegible],495	151,555	....	....	109,124	125,448	....	....
December	38,680	134,260	....	....	44,157	59,641	....	....
	755,778	$2,454,515	....	....	977,997	$1,140,929	....	....

§Includes white nonstaining portland cement.

Editor Comments on the "Cement Trust"

THE Los Angeles, Calif., city council acted wisely in repealing—by unanimous vote—the spot-zoning ordinances which would have permitted the Alphonzo Bell interests to build essential portions of a cement plant in the heart of one of southern California's finest residence districts. Several members of the council reversed themselves in voting the repeal, some more than once, since they were members of the old council which voted the ordinances in the first place and which as recently as a month ago, voted that the ordinances should go on the ballot for a referendum.

Any shadow of excuse for granting the permits to "fight the cement trust" has long since disappeared. The Bell plant could not have offered this so-called cement combination, if there was any such thing, effective competition without making an intolerable nuisance of itself by going into large-scale production, and there were easier and simpler methods of curbing the "trust" in any event, by opening up the city specifications. —*Los Angeles* (Calif.) *Times.*

Savings with Road Surfacings Pay Their Cost

CLOSE STUDIES of heavy traffic roads show that in specific cases the user taxes or tolls paid by motor vehicles more than pay the road costs, including a sinking fund for replacement. On light traffic roads, the cost of the improvement is not entirely met by the user taxes and the property owners pay part of the cost, according to W. R. Smith, president of the American Road Builders Association.

If half the traffic is on the 700,000 miles of surfaced roads out of the 3,000,000 miles in the United States, a simple computation shows the saving due to road surfacing, continued Mr. Smith. It is accurately estimated that the money saving to a motor vehicle driver is from 2 to 4c. per mi. traveled when the road is surfaced as compared with a dirt road. A saving of 2c. a mile on the 700,000 miles surfaced on which half the miles are traveled amounts to $1,800,000,000 annually. This is several times the cost of maintaining these roads. The annual saving in money due to the surfaced roads about equals the total expenditures each year on all roads and streets.

Completed Figures on Cement in 1929

THE Bureau of Mines, under date of June 11, 1931, has issued the tabulation of statistics on cement production and shipments of United States plants in 1929. These statistics are the final totals of the monthly figures supplied by them and published currently in ROCK PRODUCTS.

Accidents Involving Powdered Coal

By D. B. Coleman

Safety Director, Missouri Portland Cement Co., St. Louis, Mo.

> ### Foreword
>
> ***THE odor of gas escaping from a leaky joint is a danger signal and steps are usually taken at once to correct it. On the contrary, if a coal line or conveyor is leaking, it often continues to leak until someone comes along who can tell someone else to fix it, yet a cloud of dust floating in the air has the same potential danger as a leaking gas line.***
>
> ***Pulverized coal in the bulk is not explosive. It becomes dangerous only when stirred up into a cloud with the proper proportions of air, and when brought in contact with an open flame or some other body having a temperature high enough to ignite it. This presents two problems, namely, preventing the uncontrolled formation of coal dust and then preventing uncontrolled ignition.***
>
> ***—The Editors.***

WE CONTEND with the problem of dust from the time coal is unloaded from cars until it is burned in the kiln, yet we often fail to recognize our problem as starting when the car bottoms are first dropped. This is probably due to the fact that coal is usually unloaded outside the building. Nevertheless, the attendant dust is none the less dangerous, for there is nothing to prevent smoldering coals within the car from igniting it.

Within the coal mill building, the best way to prevent the formation of dust in dangerous quantities is to keep the place scrupulously clean. One operator saw his department filled with flames when vibration from a quarry shot brought down clouds of dust from the rafters. Unfortunately the fire door to the drier furnace was open at the time. Another had a similar experience when a compressed air line broke, blowing dust toward the furnace.

The work of house-cleaning must be carefully planned and executed, for in such an arbitrary measure one certainly would not want to create the very condition we are trying to avoid, namely, dust formation. As was the weekly plan in one plant, a hose was turned into the drier furnace and all fires apparently extinguished. Ten men were put to work sweeping down coal dust, starting from the top of the building. Within a few seconds the entire place was filled with dust. From some unexplained source it was ignited. Nine of the ten men were burned to death.

The road to another accident was paved with good intentions when compressed air was used to blow the dust from the tops of the boilers in a power plant. Naturally, it was immediately put in suspension and exploded when it reached the fire door of the boiler.

Aids to Safe Cleanliness

As an aid to safe cleanliness it is recommended:

(1) That buildings be designed to secure minimum lodgment of dust. With this in mind one coal building was actually built with the siding on the inside of the purlins. In existing buildings it may mean putting sloping shields over purlins and roof members, on which dust cannot accumulate.

(2) That wherever possible the building be designed so that interior parts on which dust might lodge will be accessible for cleaning.

(3) That the inside surface of walls be as smooth as possible.

(4) That there be liberal use of white or light colored paint. It will not only give more light but will have a marked psychological effect.

(5) That screw conveyors and belts be carried on solid flooring to prevent excessive dust formation in case of spill.

(6) That dust in the building be avoided by the use of dust collectors. If a cloth type is used it should be enclosed in a metal case and the fabric electrically grounded.

(7) That if compressed air must be used, it be only in connection with a water spray after careful experiment. Air may be used for blowing out motors and such inaccessible places, but it is advised that this be done just after the room is cleaned.

(8) That if large quantities of dust must be swept, it be carefully wet down prior to sweeping.

(9) That a vacuum cleaner is most desirable. In event it is installed: (a) It should be of the permanent type because of the hazard attending the use of the flexible cable on the portable type. (b) The nozzle and handle should be of non-ferrous metal, fibre or other non-sparking material. (c) Hose, nozzles, handles, and other metal parts should be electrically grounded to the piping system and that system in turn grounded to the earth. (d) Dust separation should take place before the dust reaches the exhauster. The discharge of the separators should be carried outside the buildings. (e) the motor and separator should preferably be located outside the pulverizer room.

Dust within equipment presents an extreme hazard because of its confinement. When ignited there is usually a wreck with serious personal injury or even loss of life.

Two repairmen entered an elevator casing, one carrying a lighted torch. The other man hit the chain with his hammer, intending as a joke to shower his partner with dust. Both men were blown out the top of the casing, one killed and the elevator wrecked.

Six men entered an almost empty coal bin to shovel out the remaining coal. Of course a cloud of dust was created which by some means was ignited. The bin was wrecked and six men burned to death.

Ignition of Confined Dust

A night shift oiler was forbidden to bring his lantern, which he carried coming to work, inside the coal room. One night he got by with it and used it inside the mill while oiling the rolls. He apparently forgot his lantern, closed and started the mill. He and the mill were blown to pieces, another man burned to death and the building wrecked.

At two different plants coal tank men lifted the covers to inspect tanks which were being filled. In each case a cloud of dust drifted out, became ignited, burned the men to death and wrecked the bins.

To prevent explosions of the type just mentioned, it is recommended:

(1) That of course all equipment be kept as dust tight as possible.

(2) That safety relief vents be provided on all necessary equipment. Tank vents should be large enough to prevent building up abnormal pressure therein. Safety relief vents from pipes or flues should have at least the same area as the pipes or flues vented, and should lead by the shortest possible vertical direction to the outside air.

(3) That all tanks have smooth inside surfaces and be so shaped that the minimum of material hangs up in the corners.

(4) That all joints be riveted, the rivets spaced to insure a dust-tight joint, and joints caulked or welded.

(5) That the bin be so designed that the coal is introduced tangentially against one of the sides in order to reduce the size of the dust cloud.

(6) That all bins be equipped with high bin signals.

(7) That no manhole or inspection door be opened while the tank is being filled.

(8) That hammering on hoppers be prohibited, for it eventually causes leaks.

(9) That no mill or elevator be entered within 20 minutes of shut down, in order that dust may settle.

(10) That when working in equipment there be the least possible creation of dust.

Obviously if we are successful in our efforts to prevent formation of dust, there is no ignition problem. However, we will have to reach the idealistic stage before we can disregard this hazard.

Explosions are caused by open fires, electric sparks, metallic sparks, spontaneous combustion, driers and smoldering fires in equipment.

Torches in a coal room are flagrant violation of good sense. Four men were burned in an elevator casing from the resulting explosion when one of them entered with a lighted torch.

At another plant an operator opened an elevator casing to tighten a loose chain. He set a torch, borrowed from the kiln room, in one of the buckets and shook the chain to see how loose it was. A cloud of dust came down, ignited and burned him so fearfully he died shortly thereafter.

On any number of occasions flashes have resulted from coal dust being blown to open furnace and kiln hood doors.

All open lights, torches, salamanders and smoking should be prohibited in the coal room.

Coal tanks should be located as far from kiln hoods and drier furnaces as is consistent with operating requirements.

That part of the building around the firing end of driers and kilns should be kept particularly clean of coal that might be carried, by wind or vibration, as dust to the fire doors.

Fires Caused by Electrical Equipment

Electrical equipment is an occasional source of ignition. In one plant a short-circuit of one of the armature coils of a motor ignited the coal dust accumulated inside the motor casing and initiated the explosion of dust throughout the building. Another explosion was caused by an electric spark from a blown fuse on the switchboard at the very moment a cloud of dust was formed by the breaking of a 6-in. drive belt.

There are any number of cases where light globes have been broken or exploded in coal tanks, the glowing filament then igniting the suspended dust in the tank.

Several explosions in a plant, one of which seriously injured six men, resulted in the discovery that a 20,000-volt charge of static electricity was being built up and discharged in a cloth type dust collector. Other causes of static charges are contact of rapidly moving parts of machinery, such as belts, rollers, balls in pulverizing mills, fan blades and particles of fine material being rapidly conveyed through chutes and spouts.

To reduce the fire and explosion hazards of electrical equipment, as just illustrated, it is recommended:

(1) That as far as possible all wires and cables in the coal pulverizing department be carried in conduits.

(2) That unless the coal room is kept free from dust, switches be placed outside the building. If this is not feasible, they should be of the oil-immersed type.

(3) That provisions be made to cut off the light and power at some remote point in event of explosion or fire. This avoids the need of entering the building.

(4) That motors not properly enclosed or protected against ignition by sparks at the commutator have no place in the coal room. Motors of the non-sparking type are the most nearly explosion-proof now available.

(5) That the bulbs on extension cords be protected by heavy wire guards and that connections and insulation be inspected frequently. It is even more desirable that lights of the flashlight type be used instead of extension cords.

(6) That where there is any possibility of the formation of a static charge, the equipment be grounded. This will dissipate the charge as it is generated.

(7) That coal tanks, conveying lines or pipe lines should not be used as supports for light or power lines, except where such lines are carried in conduits.

D. B. Coleman

Metallic Sparking

Lack of evidence of explosions due to metallic sparking does not mean the hazard is unimportant.

Magnetic separators should be provided ahead of all pulverizers of other than ball- and tube-mill type. Coal that has passed the separator should then be protected to prevent re-entry of foreign material. Separators should be protected by interlock or alarm systems to prevent passage of coal when not magnetized. In connection with sparking, it is interesting to note that the National Board of Fire Underwriters state that "Non-ferrous metals need not be used in the construction of fan blades or lining of fan casings."

Smoldering Fires

Unsuspected fires in equipment have caused immense damage. In one case the boilers were shut down and fires apparently killed for the regular weekly inspection of the coal mill. The fan was started up to clear the mill of coal, the dust blown into the boiler. A few minutes later there was a terrific explosion, the dust ignited by some embers in the fire box. The shift engineer was blown into the air and killed, the superintendent and mill operator sent to the hospital for four and eight months respectively and the boiler room wrecked.

In another coal grinding department the building was wrecked and 12 men killed when the department was again started up after a fire in an elevator boot was thought to have been extinguished.

In another plant an explosion occurred, burning 8 repairmen to death. While the mill was being repaired one of the men rammed a stick with some waste on it into the part he was cleaning. Smoldering fire apparently ignited the waste, which in turn ignited the dust created by the repair work. There was a flash in the mill and then flames traveled back and forth several times across the room with a strange hissing noise, apparently the result of dust shaken from overhead by the first flash in the mill.

It is recommended:

(1) That when the fan is to clear the mill of coal, the induced-draft fan be placed in operation or the stack draft be wide open before the mill and exhauster fan are started.

(2) That a lighted torch always be placed in front of the burner, even though boiler or kiln are down.

(3) That the system be so interlocked that the mill and fan cannot be put in operation ahead of the induced-draft fan.

(4) That all equipment be regularly inspected for smoldering fires, particularly before being opened for repairs. A fire may smolder in the system in operation without damage, due to lack of air. Opening the system and starting repair work may create the proper dust suspension for an explosion.

(5) That when a fire is found in equipment, except tanks, it be carefully flooded with water and then shoveled out of the system.

Spontaneous Ignition

Spontaneous ignition, though a serious problem, never causes an explosion unless the dust is stirred up, allowing suspension in air.

To prevent spontaneous ignition, it is recommended:

(1) That a study be made of the coal used at each plant to determine its susceptibility to spontaneous ignition.

(2) That storage tanks be located as far as practicable from boilers, kilns, steam pipes, or other sources of heat.

(3) That they be regularly inspected inside and out when coal is stored for any length of time, to determine whether there is any increase in temperature or whether there are fumes from smoldering fires.

(4) That whenever a plant is idle for more than two days, all tanks be thoroughly

inspected before permitting operation to be resumed.

(5) Whenever possible, all pulverized coal should be burned before the plant goes down.

(6) That no coal, crushed or pulverized, be stored when its temperature exceeds 150 deg. F.

Drier Is Keystone of Safe Operation

Now for the drier. There is almost no doubt that the keystone to safe operation of a coal department is in the proper operation of this piece of equipment. The majority of explosions and fires can be traced directly or indirectly to overheated coal, which is generally caused by either too hot a fire in the drier furnace, or the continuance of the fire after the drier has been shut down with coal in it.

One typical case will suffice. The pulverizing mill in a cement plant had been shut down because kiln tanks were full. Just as it was being started a few hours later it exploded. The attendant shock brought down accumulated coal dust from overhead which in turn exploded, wrecking the building. Two men were killed. The investigation proved the explosion due to one of two sources. Either some hot coal remained in the mill when shut down and grew hotter until it needed only the additional aid supplied by the simultaneous starting of mill and fan, or, due to drier operator's neglect, the coal was practically red hot when fed to the mill.

To help in the safe operation of driers, it is recommended:

(1) That equipment be so interlocked that when the drier is shut down there is no continued heating of the coal.

(2) That operation be controlled by temperatures taken of the coal at the discharge of the drier. Such control compensates for variations in coal moisture and feed. Usually 90 to 125 deg. F. on drier discharge will dry most coals satisfactorily.

(3) That there be a temperature indicator and alarm system in the range of vision and hearing of the drier operator.

(4) That if the coal is at all variable, automatic temperature control systems may be a good investment.

(5) That when necessary to reduce drier temperatures this be done by lowering air temperatures rather than air quantities.

(6) That in direct driers, the gases of combustion should not come in direct contact with the coal before at least halfway back in the drier, and in no event within 12 ft. of the fuel bed.

(7) That the drier be run empty before shutting down.

(8) That shavings or other light inflammables should not be used in starting drier furnace fires.

(9) That operating schedules be so arranged that no dried coal is stored for more than 24 hours.

(10) That the drier operator be a reliable man who thoroughly understands his work.

Overheating of Bearings

Overheating of bearings is another source of ignition. This hazard may be eliminated:

(1) By frequent inspection and oiling.

(2) By keeping bearings, in fans particularly, on the outside of equipment.

(3) In case of unusual hazard, by a bearing alarm system.

A coal dust explosion cannot be handled. It must run its course. If it is not prevented, the next best measure is to see that there is sufficient fire fighting equipment to fight the subsequent fire, to be used only after all dust has settled and after the circuit breaker is knocked out.

What to Do in Case of Fire

In case of bin fires:

(1) Cut off the coal supply to the storage bin.

(2) Shut off the carrier air supply to the bin.

(3) Close the bin vent damper. If the damper is automatic, make sure that it has properly closed.

(4) Make sure that all other openings into the bin, other than the feeders, are tight.

(5) The foreman, fireman, or person in charge should be notified at once. It is this man's responsibility to exercise his judgment and determine whether the fire can be extinguished by its own fumes. If the fire has not gained headway and the bin has been tightly sealed, the fire will die because of lack of oxygen.

(6) In some cases where the fire has gained considerable headway, the vent damper may be damaged or the seams may have opened. It is important that every effort be made to close these openings with water soaked non-combustible material.

(7) When all of the bin openings have been tightly closed and the vents sealed, this will prevent the circulation of air and will create an atmosphere high in carbon dioxide. When all of the available oxygen in the bunker has been exhausted, the fire in most cases will smother out.

(8) Live steam or inert gases may be used to smother a fire if it gains headway. Steam and water should be used carefully as it may create a dust cloud within the bin, and thus set up an additional hazard of explosion. Water should not be used unless absolutely necessary. It has little value in putting out a fire in large quantities of pulverized coal and makes it practically impossible to use the feeders.

(9) The bin should be emptied as quickly as possible, even while the fire is in progress, by feeding coal to the kiln. This emptying process should be carried on regardless of the difficulties experienced in the feeders due to lumps of coke.

(10) If it is impossible to feed the coal to the furnace through the feeders, the bin should be sealed and the fire completely extinguished before the bin is opened.

(11) Care must be exercised in opening a bin which has been sealed to extinguish a fire, so that any flammable gases which may have been generated during the time the bin was sealed will not be ignited when it is opened.

(12) If all attempts fail to clear the feeders, men must enter the bin. In all cases, it should be thoroughly ventilated to eliminate any fumes and to make sure that the fire is really out. This work should be in charge of responsible parties. Men entering the bin should be equipped with positive pressure helmets or oxygen breathing apparatus, and also with life belts and life lines. Life lines should be in charge of a second worker outside the bin, and the man inside should be watched at all times.

(13) In some cases it will not be necessary to empty the bin after a fire, but when doing so, coal should never be discharged on the floor through the opening in the bottom. It should be removed either by disconnecting the feed pipe and discharging into buckets, or by bucketing the coal out through the top manhole. Fire of bulk coal in other equipment may be fought by the same measures.

Safety Council Meeting

THE PROGRAM for the 20th annual congress of the National Safety Council, to be held in Chicago, Ill., October 12 to 16, has been issued. The program of the cement section starts Tuesday the 13th at 2 p. m. and is as follows: Annual report of R. B. Fortuin, general chairman; report of nominating committee and election of officers; "The Relation of Labor Turnover to the Accident Curve," by W. L. White, Jr., assistant general manager, Medusa Portland Cement Co., Cleveland; discussion, "Accident Investigations from the Employe Point of View," by R. A. Finch, safety engineer, Bureau of Safety, Chicago; discussion, "Safety vs. Carelessness."

Wednesday morning—"The Advantage of Physical Examination and Re-examination to the Employe," by Dr. W. J. Fenton, American Red Cross, Washington, D. C.; discussion, "Minimizing Pulverized Coal Dust Hazards in Cement Mills," by D. Harrington, chief engineer safety division, U. S. Bureau of Mines, Washington, D. C., and discussion.

Luncheon Wednesday is to be held jointly with the quarry section, as well as meetings in the afternoon. A talk will be given on "Safety and the Interdependence of Men" by D. D. Fennell, vice-president, Turner and Turner, Chicago, Ill. In the afternoon an open discussion on the "Value of the Plant Magazine" will be led by A. R. Couchman, safety director, North American Cement Co., Hagerstown, Md. This will be followed by an address by Professor Stevens, Department of Psychology, Northwestern University, Evanston, Ill., and another discussion. This ends the program of the cement section.

The Thursday morning session of the quarry section is to be opened by A. L.

Worthen, general chairman of the quarry section. An address on the "Progress of Safety in the Quarry Industry" by W. W. Adams, chief statistician, demographical division, U. S. Bureau of Mines, Washington, D. C., will then be followed by a discussion. The report of nominating committee and election of officers will follow. An address will then be given on "The Executive's Viewpoint of Safety in the Quarry Industry," by John Prince, president Stewart Sand and Material Co., Kansas City, Mo., which will be followed by discussion. Another address, "The Superintendent's Viewpoint of Safety in the Quarry Industry," by E. M. Gould, superintendent, Cape Girardeau plant, Marquette Cement Manufacturing Co., Cape Girardeau, Mo., will be given and followed by discussion.

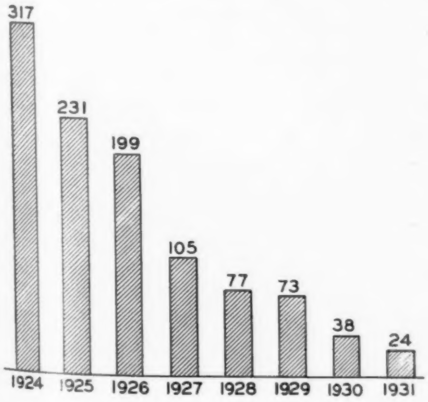
Compensation Insurance

Thursday afternoon the program will start with a talk on "The Operations of the National Council on Compensation Insurance and its Relation to Compensation Insurance Rates," by a representative of the National Council on Compensation Insurance. After a discussion of this talk another talk will be given on "The Relationship of Insurance Companies to the General Promotion of Accident Prevention." This speaker will be announced later, as well as the following speaker who will talk on "Safety as Viewed by a Foreman." A discussion will follow each of these talks.

Cement Mill Accidents During July

DURING July, 1931, 22 lost-time and two fatal accidents occurred in the member mills and quarries of the Portland Cement Association. The preceding month's record shows a total of ten lost-time and three fatal mishaps. July, 1930, furnished a record of 38 lost-time accidents with no fatalities.

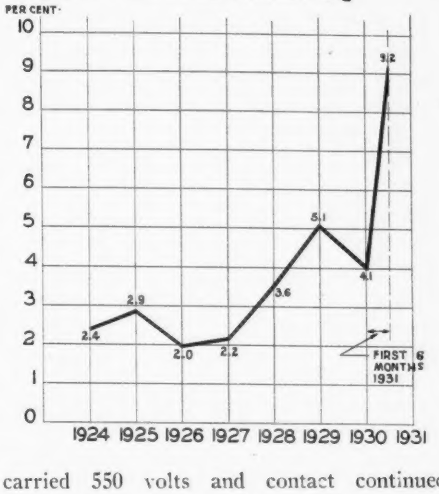
While the accident frequency rate in the cement mills continues to recede, the persistency with which fatal accidents continue furnishes a disquieting note. At a time when the accident totals for these mills averaged 250 per month, fatalities averaged only 1 to every 50 lost-time accidents; the proportion for July, 1931, is 1 to 11 and for the first six months of 1931 is 1 to 9.2. This condition is not peculiar to the cement industry, however, but parallels the experience reported in several other heavy manufacturing lines in which accident frequency is on the down grade.



July accidents in cement plants

The first of the two fatal accidents reported during July occurred when an electrician grasped a live lead wire with his bare left hand. He was immediately before a safety switch box and "shorted" one of his fingers on the switch blade keeper. The line

FATAL ACCIDENTS
AS A PERCENTAGE OF ALL ACCIDENTS
[LOST-TIME PLUS FATALITIES]



carried 550 volts and contact continued about 4½ minutes. Resuscitation efforts were used immediately and continued for more than 3 hours, the rescue crews ceasing only when rigor mortis set in.

In the second fatal accident, an employe of the burning department was engaged in unplugging the overflow pipe line at the upper end of the kiln. In moving his foot out of the ensuing slurry stream he slipped, lost his footing, and fell from the top of the kiln to the floor 45 ft. below. He died 3 hours later as a result of a broken back and fractured skull.

State Industrial Commissioner Pays Tribute to Cement Plants

THE CEMENT COMPANIES of Oregon received gratifying mention from Arthur W. Lawrence, state industrial commissioner of Salem on the report of their safety progress as contained in the June statistics of the Portland Cement Association. "These cement companies should be highly commended," Mr. Lawrence said. "In our safety work here in Oregon we find the cement companies are definitely sold on this work and are portraying a splendid spirit of cooperation."

A. R. B. A. Committee to Meet

A MEETING of the executive committee of the City Officials' Division of the American Road Builders' Association will be held in Detroit, Mich., September 4.

May Develop Black Glass Industry in Wisconsin

DEVELOPMENTS of a large black glass industry in connection with the Black Granite quarries at Dudley, Wis., about 30 miles southeast of Tomahawk, is the reported mission of A. W. Gentry of Chicago, who has spent the past few weeks at Wausau, Merrill and Rhinelander, negotiating with mortgage holders, whereby the interests represented by Mr. Gentry may obtain control of the Dudley quarries. Considerable money has already been spent in laboratory work.

According to Mr. Gentry, the glass industry is second only to the automobile business in this country. The black glass industry is growing rapidly and its products are being used in thousands of articles, he said.

The Dudley granite contains 20% aluminum and 18% iron, of which 14% is magnetic iron.

Mr. Gentry has interested financiers in the possibilities of Dudley black glass, and intends to incorporate a parent company under Illinois laws for approximately $2,000,000. He estimates that it will be necessary to invest from $250,000 to $350,000 in the Dudley plant, where it is estimated that the supply of black granite is ample for 100 years.

The Dudley company has operated sporadically since its start in July, 1929. The plant is not now in operation. Mr. Gentry claims that if he acquires the property and forms a new company, all creditors' claims will be paid. The Dudley brothers will be paid on a royalty basis.—*Tomahawk* (Wis.) *Leader.*

Oklahoma Has Large Deposits of Rock Products

FEW CITIES OFFER to the manufacturer so many advantages in such great measure as does Oklahoma City, Okla., according to John A. Brown, president of the Chamber of Commerce.

Quoting estimates by Dr. Charles N. Gould, for many years head of the Oklahoma Geological Survey, Mr. Brown showed Oklahoma to have vast stores of many major products essential to industry. Many of these are shown to be practically inexhaustible.

There is enough glass sand in Oklahoma to manufacture all the glass used in the world, Dr. Gould's estimates show, Mr. Brown pointed out.

Gypsum deposits total probably 123,000,000,000 tons, enough to keep 100 mills busy 34,000 years. Limestone reserves are sufficient to burn all the lime and furnish all the crushed rock for the entire country.

Other materials available in sufficient quantity to supply the country or a major part of it for all time include: cement rock, clay, and shale, granite, sandstone, gravel and building sand, novaculite and many others.—*Oklahoma City* (Okla.) *Times.*

Says Magnesium Limestone Is Satisfactory for Fertilizer

DIFFERENCES in prices ranging from \$5 to \$10 per ton for limestone and from \$10 to \$35 per ton for hydrated limes during the past year were revealed by studies of liming material offered for sale in New York made by the chemists of the New York state agricultural experiment station in Geneva, who are charged with the inspection of all fertilizing materials and soil amendments sold in the state. Similar wide differences in the composition of these materials were also shown by chemical tests which determine the neutralizing value of the compounds when applied to the soil.

The agricultural liming materials most commonly used in this state at the present time are ground limestone and hydrated lime, say the station chemists, and in checking up on these compounds, a comparison is made of the combined calcium and magnesium oxides found upon analysis with the guaranteed neutralizing value placed on the material by the producer.

Of the 60 to 70 samples examined very wide differences occurred between the actual amounts present and the guaranteed composition, but in most cases the differences were in favor of the purchaser, it is said. A report on these tests has been prepared by the station chemists.

Referring to the prejudice against the use of magnesium limestone that has prevailed to some extent in the past, the station chemists assert that there is no foundation in fact for discriminating between this substance and ordinary calcium limestone. In fact, ample experimental evidence is available, they say, to show that the neutralizing value of magnesium limestone exceeds that of calcium limestone by as much as 16%. There was on the average a little over 7% of magnesium oxide in the limestones tested at the station this past year and about 13% in the hydrated limes.—*New York* (N. Y.) *Times.*

New Ruling on Oregon Gravel Royalties

FOLLOWING a controversy on gravel royalties in the state of Oregon which it was recently announced would be levied on contractors furnishing gravel for the county roads when this gravel was taken from navigable rivers of the state, George L. Pipes, chief civil deputy district attorney, handed down an opinion to the county roadmaster that this tax would not be required.

Attorney Pipes said the code provides for the leasing of gravel beds by the state land board, but contains an exception to the effect that counties shall not be required to pay anything for removal of gravel, sand and rock devoted to public uses. Mr. Pipes pointed out that if the contractor did pay royalties to the state, this expense would be charged to the county in the bid.

Issue Program for International Association for Testing Materials Meeting

THE PROGRAM of sessions of the new International Association for Testing Materials to be held in Zurich, Switzerland, September 6 to 12, has been issued.

The sessions for the nonmetallic inorganic materials section are designated as Group B and will be held in Auditorium II of the Swiss Federal Polytechnicum, Zurich, from September 8 to 11 inclusive.

On September 6 a reception of members, guests and ladies by the International Association and the Swiss Association will be held from 7:30 a. m. to 8:15 p. m. At 8:15 the opening address will be given, after which refreshments will be served. Monday afternoon, September 7, various excursions are planned.

The program of Group B Tuesday morning will be on natural stone. In the afternoon the subject will be on "The Influence of Chemical Agents on Cement and Concrete." Wednesday morning the subject will be "Cements with Hydraulic Ingredients" and in the afternoon the subject will be "Aluminous Cements." Thursday the "Strength, Elasticity and Compactness of Concrete" will be discussed and the program of the group on Friday will be "Reinforced Concrete." This ends the sessions of the groups.

Saturday afternoon a plenary session will be held, with a closing banquet in the evening.

Sunday, September 12, a general excursion to the Grimsel and a visit to the Oberhasli Power Co. hydroelectric plants have been arranged.

South Carolina Road Program

SOUTH CAROLINA has called for highway bids amounting to about \$3,500,000 for August 28, and when the projects included in this letting are completed, every county seat in the state will be connected with a hardsurfaced road, according to the state highway officials.

South Carolina let \$6,500,000 worth of work in July, so with the new \$3,500,000 will have let \$10,000,000 worth of work in two months. With road and bridge work amounting to \$33,000,000 having been let since May, 1930, the new letting will bring the total to \$36,500,000 in 15 months.

Proceedings of the Highway Research Board in 1930

THE PROCEEDINGS of the 10th annual meeting of the Highway Research Board, held at Washington, D. C., December 11-12, 1930, are now available in bound form. This 420-page book giving all papers, discussions, committee reports, etc., may be obtained from the National Research Council, Washington, D. C.

Reduces Price of Agricultural Limestone

THE Kentucky Stone Co., Stephensburg, Ky., has made a special rate on agricultural limestone for the month of August.

Limestone will be loaded in minimum cars of 50 tons per car at 75c a ton, f.o.b. Stephensburg. The regular price has been 90c a ton.

This is the cheapest that agricultural lime has been in the past seven years. The lime bins that have been constructed at Clarkson, Leitchfield and Caneyville will continue to distribute lime, but farmers can club together and buy lime by the carload and save the cost of unloading, shrinking in waste of handling and weighing.

Lime is the basis of our soil improvement work and can be applied at any time during the year.

Lime as much as you can each year until you have covered your entire cultivated acreage, is the advice of County Agent H. S. Patterson.

The old slogan, "Lime—Put it on; don't put it off," is still true and it is more expensive to try to do without it than it is to use the soil treatment.—*Mobile* (Ala.) *Register.*

A Valuable Story on Agricultural Limestone

THE FOLLOWING STORY, which appeared in the *Ashland* (Ky.) *Independent,* should do much to further increase the use of agricultural limestone in the locality in which it was published. An equally good story no doubt exists in many localities and would be beneficial both to farmers and producers of agricultural limestone if it were published.

N. B. Fannin, owner of a large farm and who lives in Boyd county, Ky., has decided that he can't afford to do without limestone on his land since good agricultural limestone is available at such a cheap price. Mr. Fannin is hauling 100 tons of limestone and is spreading it over 25 acres where he plans to grow red clover.

It is now an established fact that the application of from two to four tons of limestone on land in Boyd county to be seeded to any of the legume crops is the most profitable thing any land owner can do.

Eight years ago less than 50 tons of limestone was used in Boyd county in 12 months time. For the past three years there has been used annually more than 1000 tons and it appears that farmers will apply at least 1500 tons this year.

Farmers in Boyd county are estimating that every dollar invested in limestone yields them at least three dollars in one year's time. This sounds like a good investment and when progressive farmers like Nick Fannin, John Hogan, Fred Ross, J. M. Ross, Charles Fannin and Walter Thornbury adopt this practice other Boyd county farmers can feel sure it is profitable.

Feldspar Company Adds Equipment—Wins Court Decision

A REPRESENTATIVE of the Kingman Feldspar Co., of which the parent company is the Consolidated Feldspar Co., was in Kingman, Ariz., recently and stated that a part of the machinery for the new crushing plant has been loaded and was ready to ship into Kingman.

The new plant is to handle about 100 tons with the single unit, but it will be built so that new units may be added at any time. The company is to make big producers of the feldspar mines, about 5 mi. northerly from Kingman. Drilling is to be done to ascertain the extent of the deposit, the depth and other production features, and the new mill units will be built in accordance with the needs of the coast and part of the middle west. The plant will also handle crushed silica as well as feldspar.

The judgment of Judge Richard Lampson in the case of George I. Taylor and others against the Kingman company, which was tried some months ago and in which briefs were filed, was recently handed down, the judge sustaining the defense on all four counts of the complaint and the cross-complaint.

It would seem that George I. Taylor and others were the owners of the big feldspar deposit that lies north of Kingman. This deposit was leased and optioned to a number of outfits at various times, finally passing into the hands of George B. McDevitt and associates, who turned the property into the Gold Cliff Central, and finally into the hands of the Kingman company.

It was this company that was assumed to have created laches in the handling of the property, although some royalties were received by the owners during the time alleged that failure had taken place.

The court held that there was no failure and in the event of all the set ups for the action that none had relevancy to the case, and that the entire case hinged on four issues that were not proven in any way.—*Kingman* (Ariz.) *Miner.*

Geologists Mapping Areas of Montana

DR. C. H. CLAPP and party are completing the geological survey of the Cooper's Lake quadrangle in Montana. Russell Gibson is completing the survey of the Libby quadrangle and J. T. Pardee of the U.S.G.S. will complete a study of the Pioneer placer district, which he began several years ago. The Princeton geological department is again working in the Red Lodge region, and Dr. Parker is studying the geology and coal resources of Custer and Powder river counties, while Arthur Collier's party is mapping eastern Montana to get information for a complete geological map of that part of the state on a scale of 1 to 500,000.

Colorado Urged to Use Own Rock Asphalt

THAT COLORADO has vast deposits of natural rock asphalt, the material specified in plans of the state highway department for a proposed 6-mi., $200,000 road in Pueblo county, was disclosed recently by F. E. Searway, Denver mining engineer.

Although some of the Colorado deposits lie within 12 mi. of Denver, little has been done toward marketing the asphalt, according to Mr. Searway, who says the Colorado road material can be sold within the state at half the cost of out-of-state asphalt.

The Colorado material consists of 40% asphalt and 60% silica. It can be obtained from open pit quarries and at one time 100 tons were removed for use in the manufacture of roofing.

One deposit near Morrison, according to Mr. Searway, is known to be a least ¼ mi. long, 75 ft. wide and 900 ft. deep.

"Kentucky and other states have similar deposits and are utilizing them for road building," Mr. Searway said. "Since the law requires that Colorado materials be favored for all public projects, Colorado has a chance to develop a new industry and at the same time make its road appropriations go much farther than at present."

According to Mr. Searway, samples of the rock asphalt were turned over to the city highway department several years ago, but no effort was made to develop the deposits. —*Denver* (Colo.) *Post.*

Open Idaho Phosphate Mines

THE California Potassium-Phosphate Co. recently started work in its phosphate mine at Paris, Ida., and will continue operations indefinitely. The company will ship its product from Paris to the mill at San Pedro, Calif., and it is reported that the company has large orders to fill. An increased demand and a better market for the product will keep the mine in continuous operation, it is believed. The phosphate produced by this company is said to test higher than any other mined in the west.

It is rumored that the company may in the near future build a refining plant at Paris. —*Montpelier* (Ida.) *Examiner.*

July Asbestos Shipments

ASBESTOS SHIPMENTS in Canada show a marked improvement during July last as compared with the preceding month, but still are under those reported for July, 1930. Exports during the month, together with comparative figures for the preceding month in brackets follow: crude No. 1, 36 tons (21); crude No. 2, 73 tons (16); fibre, 4383 tons (4319); shorts in bags, 4304 tons (3733); and refuse in bulk, no shipments in either month.—*Toronto* (Canada) *Financial Post.*

Rules Casualty Firm Must Pay Contractor's Debts

A DECREE has been entered in the United States district court at Norfolk, Va., by Judge Meekins, of Elizabeth City, N. C., in which judgments aggregating approximately $50,000 in principal and interest have been awarded certain individuals and corporations against the Maryland Casualty Co., Inc., on a bond the company furnished Hudson and Scruggs, Inc., contractors, who several years ago were under contract for certain street construction work in South Norfolk.

The main point involved in the case was the question of the validity of the bond for protection of individuals and corporations which furnished Hudson and Scruggs, Inc., now bankrupt, with materials and labor for the street construction work. When the case originated, Judge D. Lawrence Groner, then judge of the District Court, appointed Col. James Mann as special master in the case. Colonel Mann held that the bond did not protect those persons and corporations who had supplied labor and materials and Judge Groner sustained Colonel Mann. The case then was carried to the United States Circuit Court of Appeals which reversed Judge Groner and Colonel Mann and sent the case back for further action. Judge Meekins was designated to sit in the matter for Judge Way when the latter disqualified himself in the action.

Judge Meekins held that the bond was broad enough to cover the supplying of all labors and materials for the contractors and that judgments should be granted against the Casualty company.

E. A. Bilisoly and Tazewell Taylor, Jr., local attorneys, represented the principal claimants in the action and Mr. Bilisoly took the case to the Circuit Court of Appeals several months ago where he succeeded in getting Judge Groner's judgment in the case reversed.—*Norfolk* (Va.) *Pilot.*

Fuller's Earth Operation in Illinois

IN a recent issue of *Illinois Journal of Commerce* an article describes the operation of Standard Oil Co. of Indiana near Olmstead, Ill., where it gets Fuller's earth for its refineries to clarify certain oils.

This deposit is about 22 ft. thick with an overburden of from 10 to 30 ft. After stripping, the wet clay is loaded in cars and taken to the wet clay shed, which will store two days supply. From here a steel pan conveyor carries the clay to a wet clay crusher where it is reduced to ¾-in. and finer. It then passes to a drier where the moisture content is reduced from about 38% to 4%. It is then cooled in tanks, from which it is carried by belt conveyor over a magnetic separator to a hammer mill. It then passes to screens where it is sized. It is bagged in 140- or 150-lb. bags.

Recent Prices Bid and Contracts Awarded

Middletown, Ohio. Contract for placing 1350 cu. yd. of gravel in Wayne township was awarded by county commissioners to A. B. Magaw at his bid of $1,201.

London, Ohio. Contract was recently awarded by the county board of supervisors to furnish 1027 tons of No. 46 stone chips at $1.65 and $1.40 per ton.

Parkersburg, W. Va. Contract was awarded Ohio River Sand and Gravel Co. to furnish the county gravel at 60c. per ton, delivered on Ohio river banks near Belleville.

Somerset, Ohio. Limestone for five county roads, totaling 3350 tons, was recently purchased for $5,380. This was $1,090 under the estimate of the county surveyor.

Eureka, Calif. The bid of Mercer-Fraser Co. for supplying 1000 cu. yd. of gravel to the city was accepted at the regular meeting of the city council. The company agreed to furnish the gravel for $1.63 per cu. yd.

St. Louis, Mo. While asphalt bids for street work have been running over the preliminary estimates, the bids for concrete paving have dropped well below. On two recent bids to the Board of Public Service for concrete surfacing one was 15% below the estimate and the other 12% below the estimated cost.

Flint, Mich. Bids for construction of 2½ mi. of concrete highway for the county were considered unusually advantageous to the county. Either of two companies will build the road for only a little more than $21,000 a mile. The road will be 20 ft. wide, reinforced with steel and cured by the special method required by the county.

South Bend, Ind.—Howard E. Stroh of Garrett, Ind., won the contract for 1¾ mi. of gravel on his low bid of $10,580. The engineer's estimate was $17,300. He also was low on a second bid for 1½ mi. of gravel road at $8,870. Reith Riley was given contract for 5 mi. of gravel road at $16,845.

Columbus, Ohio. Contracts for the purchase of cement, washed sand and gravel were awarded recently by the city board of purchase.

They included: Hamilton-Parker Co., 750 bbl. of cement, $1,027.50, and Columbus Builders Supply Co., 1200 tons of washed sand and gravel, $600.

Stillwater, Minn. Paul Schuman, Morgan, Minn., was awarded contract for graveling 11.9 mi. of state highway at $4,936.

Holdrege, Neb. At a special meeting of the county board Paul Sawyer was awarded the contract for gravel surfacing on the Phelps county roads, with a bid of $1.22½ per cu. yd. The 1931 bid, which is 12,000 cu. yd. of gravel surfacing 1-in. deep, is somewhat lower than last year's bid. The 1930 bid was $1.40 per cu. yd. for 18,500 cu. yd.

Maquoketa, Ia. Contracts for gravel surfacing approximately 26 mi. of Clinton county roads were awarded by the county board of supervisors at Clinton to Myron Baker of Owen and the Bellevue Sand and Gravel Co., Bellevue. Baker bid $1.09 per yd. for gravel to be taken from the DeWitt pit and the Bellevue company bid $1.07 per yd.

Indianapolis, Ind. County commissioners allowed contract for building a ½-mi. gravel road in Wayne township recently to Marshall R. Oberholtzer, contractor, for $1,937.

Construction Gains Shown in Permits

IN CONTRAST to the usual June-July trend, a gain of nearly 6% in the proposed costs of new buildings covered by permits issued in 338 of the country's larger cities was shown in July as compared with June, according to a statement made public as of Aug. 22 by the Bureau of Labor Statistics of the Department of Labor.

Estimated costs of residential buildings dropped off but were more than offset by a rise of 28.8% for nonresidential structures, it was stated. For 289 identical cities, total construction showed a drop of 34.3% from July, 1930, to July, 1931.

Report Highway Contracts Still Being Awarded

STATE HIGHWAY AUTHORITIES were employing a total of more than 325,000 men during the month of July, and contracts are continuing to be awarded for construction so that the work made available from this source will continue well into the autumn, according to estimates made public, August 21, by Fred C. Croxton, acting chairman of the President's Emergency Committee for Employment.

Mr. Croxton's statement was based on estimates given him by W. C. Markham, executive secretary of the American Association of State Highway Officials, which included definite tabulations for 38 states. These showed that the 38 states let contracts in July totaling $77,153,000 for 6127 miles of highways.

The reports, Mr. Croxton asserted, indicated that the states have used up the $80,000,000 in emergency funds appropriated by the federal government, and that the states are proceeding now with their own funds.

Survey of Current Business

THE Annual Supplement of the Survey of Current Business has been issued by the Department of Commerce. This report contains comparative monthly figures on cement production, shipments and stocks on hand from 1923 to 1930, also data on concrete pavement awards and Federal Aid highways.

The report also contains similar statistics on sand-lime brick. Building contracts awarded are separated by types of construction.

Erratum and Addenda to "Production Data on Ready-Mix Concrete"

AN ERROR was made in Tables II and III of the article, "Production Data on Ready-Mix Concrete" by Fred C. Wilcox in the August 15 issue, pages 91-94, of ROCK PRODUCTS.

These tables showed the high, low and average costs of the unit materials and the total materials required for making 1 cu. yd. of 1:2:4 crushed stone and gravel concrete, based on material prices shown in Table I, and also on quantity factors.

The arbitrary quantity factor for stone as given by Mr. Wilcox was 0.90 cu. yd., meaning 90/100 of a cubic yard of stone was used to make 1 cu. yd. of 1:2:4 crushed stone concrete. This was printed as 90c. per cu. yd., a printer's and proofreader's slip. The same error was made on all six of the quantity factors in Tables II and III.

Further data on comparative prices of ready-mixed concrete have been submitted by Mr. Wilcox, which supplement the above article. He suggests that since the selling prices of ready-mixed concrete in his summary were based on prices in effect in 1930 that it is of interest to compare them with 1931 quotations on ready-mixed concrete printed in a recent issue of ROCK PRODUCTS. The comparison shows the 1930 figures to be closely in line with current prices.

NET SELLING PRICES OF 1:2:4 CRUSHED STONE AND GRAVEL CONCRETE, PER CU. YD.

	1930*	1931†
High	$8.70	$9.31
Low	6.17	6.50
Average	7.60	7.52

*Summary of 16 plants. †ROCK PRODUCTS, issue of July 18, 15 plants.

Export Opportunities

ANOTHER ISSUE of "What the World Wants" has been published by the Department of Commerce, Washington, D. C. Detailed information may be obtained without charge upon application to any branch office of the Bureau of Foreign and Domestic Commerce by referring to the identification number. In the latest issue inquiries are reported for portland cement from Camaguela, Honduras, and for white abestine from Hamburg, Germany. The number of the first inquiry is 53324 and of the second 53264.

Rock Dust Saves Mine

APPROXIMATELY 100 miners escaped injury when an accumulation of gas exploded August 11 in the Exeter mine of the Kingston-Pocahontas Coal Co. at Hemphill, near Welch, W. Va., killing one man and injuring another.

"Rock dust saved the mine," Robert M. Lambie, chief of the state department of mines, said at Charleston.—*Morgantown* (W. Va.) *Post.*

Cement Products

TRADE MARK REGISTERED WITH U. S. PATENT OFFICE

Oregon Plant Makes Diversity of Products

By W. A. Scott

Well stocked yard of cement products at Astoria, Ore.

ASTORIA, ORE., with an historic background and a strategic setting at the mouth of the Columbia river, is a commercial, industrial and transportation center. Here the Columbia river highway from the east connects with the Oregon coast highway that skirts the 405-mile coast line of the state. Eventually, the wide river channel will be spanned by a bridge between Astoria and the Washington shore. The activities here relate mostly to fishing, lumber, farming and dairy products.

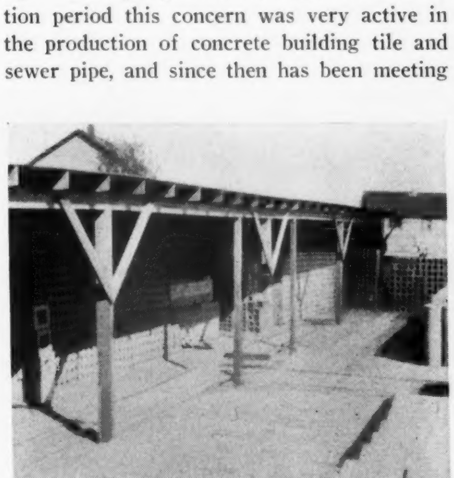
The city, originally of wooden structures, was practically destroyed by fire 10 years ago. This was followed by thorough reconstruction, for which concrete was utilized principally. This type of work was applied to the sea wall, the supporting substructures for the commercial streets, and to business buildings, sewage drains, pavements and sidewalks. In general aspect, Astoria is a city of concrete structures.

Demands for Concrete Products

During Astoria's period of construction and development after the fire there were heavy demands for concrete products, principally in the form of sewer pipe and structural units. Gradually this line of business extended to the beach towns of Seaside and Gearhart and several villages in Clatsop county. Then, as state and county highway activities expanded, the demands for concrete culvert pipe became of major importance. Some sections of highway along this part of the coast required roadbed drainage for which thousands of feet of concrete drain tile were used. Meanwhile, the installations of concrete septic tanks and sewer pipe in the rural districts have materially increased.

Astoria Concrete Products Plant

The plant of the Astoria Concrete Products Co., controlled and operated by J. W. Ellis, was established a number of years ago. During a part of the city's reconstruction period this concern was very active in the production of concrete building tile and sewer pipe, and since then has been meeting the much lighter demands from Astoria and the smaller towns. The company's best business during the more recent years has been the production of concrete culvert pipe on orders from the state highway department and Clatsop county.



Part of storage yards under cover

In addition to these leading lines, the company has been turning out other products which are factors in keeping the plant busy. Among them are drain tile, septic tanks, concrete trays for cooling bottled milk, chimney block, both plain and rock faced; concrete grave markers, and garden and lawn furniture.

The company's plant has a 200-ft. front on Commercial street, extending back 400 ft. to the railroad. The equipment consists of a Dunn Manufacturing Co. machine for the manufacture of structural units and drain tile; and a Tuerck-MacKenzie pipe machine for culvert and sewer pipe in sizes from 4 in. to 30 in. Each of these operating units, including a concrete mixer, is motor driven through transmission belts.

The building units made on the Dunn machine comprise the three sizes for main wall construction, and two sizes for partition tile. In addition to machine made building units, there is produced the poured and tamped tile. About 16,000 units of these two classes recently were made, mostly for basement walls.

The batch mix for producing building tile

consists of 1 sack cement, 1½ cu. ft. of coarse sand, 1½ cu. ft. of mason's sand and 1 cu. ft. of pea gravel. The water required amounts to about 3 gal. per batch.

The aggregates in a 1-sack batch of concrete for drain tile consist of 1 cu. ft. of mason's sand, 1½ cu. ft. of coarse sand and 1 cu. ft. of rock screenings, running from ¼-in. to dust. The speed-run of the Dunn machine on drain tile is about 1200 units in 8 hours. There is used about 2½ gal. of water per batch.

Supplies of Aggregates

Aggregates for the plant are purchased from the Brookfield Co. and the City Lumber and Supply Co. of Astoria, both of which are material dealers and producers of Columbia river sand. Their supplies of sand are recovered from deep-water deposits in the vicinity of Oak Point, 40 miles upstream from Astoria. In each case the producer operates a clamshell dredging outfit, loading the sand onto a barge for transport to storage bins at Astoria docks, where the material is washed and graded. Most of the gravel used here consists of Willamette river material, shipped to Astoria by the Portland Gravel Co.

Then the Brookfield Co. operates a rock quarry, crushing and screening plant on the Washington shore, below Oak Point, the rock products being barged down to Astoria. The grades purchased by the Astoria Concrete Products Co. comprise 1½., ¾-in., ½-in., and screenings from ¼-in. to dust. These rock products are said to be washed at the plant to eliminate the soil derived from some of the quarry overburden.

Display Farm Uses of Limestone

A SPECIAL BOOTH at the fair held recently was devoted to limestone displays this year. The lime is manufactured locally by the Farm Aid Limestone Co. The exhibit included samples of the crushed stone, and mineral feed, production of which was started recently by the local organization.—*Huntington* (Ind.) *Press.*

Use of Ready-Mixed Concrete Saves $4 Per Yard

AN EXAMPLE of very helpful publicity for ready-mix concrete is found in the current issue of *Railway Engineering and Maintenance:*

"A saving of at least $1200 was made recently by the Chicago, Burlington and Quincy in providing 300 cu. yd. of concrete for a job at Minneapolis, Minn., by buying ready-mixed concrete rather than mixing the concrete at the site. This concrete was required for the floor and roadways of a new fruit house at North Seventh street and Hoag avenue. This is a steel-frame, industrial-type structure, 200 ft. long by 90 ft. wide, affording a clear headroom of 22 ft. under the roof trusses, and the only concrete involved was that required for the foundation piers, floors and roadway pavement.

"The Burlington has always done a large part of its concrete work with its own forces. However, after taking into account the cost of shipping in the concrete mixer and other equipment required and the camp cars for the gang, as well as the long haul on the aggregates, and the switching charges involved because the fruit house is an off-line facility, it was concluded that these incidental costs would result in an excessive charge per yard against the limited quantity of concrete required. When the estimated cost per yard on this basis was compared with the price at which ready-mixed concrete could be purchased in Minneapolis, delivered at the job, it was found that the latter would be much cheaper than concrete made by company forces, taking into account the labor of placing the concrete after it was delivered. It was concluded also that the same relation would prevail with respect to concrete work done on the job by a contractor.

"Accordingly a contract was awarded to the Ready Mixed Concrete Corp. of Minneapolis to furnish 300 cu. yd. of concrete. The specifications called for a 1-2-4 mix, subject to the approval of the railroad's inspection as to consistency. Little form work was required other than wooden bulkheads along the edges of the roadway and for construction joints, so that the labor which the railway had to provide was confined largely to placing the concrete and floating the surface. The few men required for this work were employed locally and the total labor charge amounted to about 25c per cu. yd.

"The concrete was hauled a distance of about three miles in tank trucks having a capacity of 2 cu. yd. and equipped with a mechanical agitator that was effective in preventing segregation. The inspector kept a close watch on the concrete as it was delivered, telephoning instructions to the mixing plant whenever, in his judgment, the workability or consistency of the concrete should be altered. He also made occasional visits to the plant. As a further check on quality, test cylinders were made at intervals for test. The results obtained were deemed thoroughly satisfactory and it is estimated that the purchase of its ready-mixed concrete resulted in a saving of almost $4 per cu. yd. under the circumstances enforced in this case.

"We are indebted for the above information to H. G. Dalton, engineer of buildings, Chicago, Burlington and Quincy, under whose direction the work was done," says *Railway Engineering and Maintenance.*

Promoting Concrete Pipe and Tile for Airport Drainage

THERE is every reason to believe that busy airports throughout the country offer excellent opportunities for products manufacturers, who produce concrete pipe and drain tile, to promote their products in considerable quantity. As soon as airport officials realize the necessity for adequate drainage, and preferably before they reach this decision, the live-wire products men will be on the job.

During the increasing air traffic of the last few years attempts to maintain surfaces of undrained landing fields have convinced airport authorities of the necessity for providing drainage of the entire airport area, thus opening up a market for pipe and tile. It is important that, during the heaviest rains to be normally expected, all water must be removed from the surface within a few minutes. Even the smallest airport contains several hundred acres and requires a considerable amount of pipe and tile.

Plant and yard of Astoria Concrete Products Co.

The following reports concerning quantities of pipe and drain tile which have been used in various airport drainage projects indicate the possible field for these concrete products:

In Eugene, Ore., 9000 ft. of concrete drain tile were used in an airport drainage system.

Approximately 8000 bbl. of portland cement were required in the construction of underground service conduits at Randolph Field, a U. S. army airport in Texas.

A total of 7350 ft. was required in airport drainage work at Cincinnati, Ohio, including 1000 ft. of 24-in., 500 ft. of 30-in., 1100 ft. of 33-in., 1050 ft. of 39-in., 1900 ft. of 48-in. and 1800 ft. of 51-in.

An airport drainage project in Milwaukee county, Wisconsin, required 10,000 ft. of 6-in. pipe, 2000 ft. of 18-in., 2400 ft. of 24-in. and 1000 lin. ft. of bridging over a creek.

Concrete block manholes and catch basins also may be promoted for airport drainage construction. At Tacoma, Wash., the requirements were five concrete block manholes in addition to the following quantities of pipe: 570 ft. of 4-in., 430 ft. of 10-in., 1500 ft. of 12-in. and 1650 ft. of 15-in., a total of 4150 lin. ft.

At Shreveport, La., drainage work for Barksdale Field involved the use of 65,210 ft. of pipe, 8-in. to 30-in. in size, a total of 1304 tons.

Maxwell Field (U. S. army), in Montgomery, Ala., is well drained, the drainage system requiring 8300 ft. of concrete pipe in sanitary sewers and 16,000 ft. of smaller sized concrete pipe for drains.

Old House Built of Cement Block

WHAT is believed to be the oldest cement block house in the United States is near the village of South Charleston, Ohio.

It is known as Glenwide, and was built in 1860 by Simeon Warner, a pioneer Ohio resident. It was built of sand, lime and cement, the latter two materials having been secured in the east and hauled in by wagon from a railroad point. The sand was taken from the farm on which the house stands.

The house has 18 rooms. It has been kept in its original condition inside and out, and is one of the show places of the community. —*Toledo* (Ohio) *Times.*

Discover Unusual Rock Deposit

DISCOVERY of an extensive rock formation at a height of 1000 ft. in Yellow Creek township, Ohio, by L. H. Johnson is attracting attention of geologists. Samples of the rock are to be forwarded to Washington for study.

Pieces of the rock show many imbedded shells, which indicates, it is said, deposits during the glacial period.

Many of these shells are ribbed on the exposed side.—*Alliance* (Ohio) *Review.*

Harborview Hospital, Seattle

An Outstanding Job Involving Cinder-Concrete Masonry for Back-up Walls

TWO of the group of buildings comprising the first unit of Harborview Hospital, Seattle, Wash., can be classed as outstanding structures involving the use of concrete masonry. Although all of the buildings erected to date are of reinforced concrete, beam and slab type of construction, the main hospital building and the nurses' home required considerable use of cinder-concrete building units.

Back-up for face brick in these two buildings is cinder-concrete masonry, approximately 175,000 units of the 6x8x12-in. size having been furnished by the Concrete Structural Units Co. of Seattle.

The hospital building was built at a cost of $1,523,394.19 or 50.8 c. per cu. ft. The nurses' home cost $507,077.11 or 55.6 c. per cu. ft.

Thomas, Granger and Thomas, A. I. A., were the architects, and the Western Construction Co. was the general contractor.

The hospital building rises 10 stories above the street, all floors above the first being devoted to patients' rooms and wards, with the exception of the seventh and eighth floors on the south wing, where operating rooms and obstetrical departments are located. The central tower rises four stories higher than the main building, and two full stories below street level are located kitchen and other facilities required in operation of this modern hospital.

The accompanying photograph shows the main hospital building and, at the right, a glimpse of one corner of the nurses' home, which includes living quarters as well as complete training departments. This building also has back-up of cinder block.

Cast Stone Plant Opens in Michigan

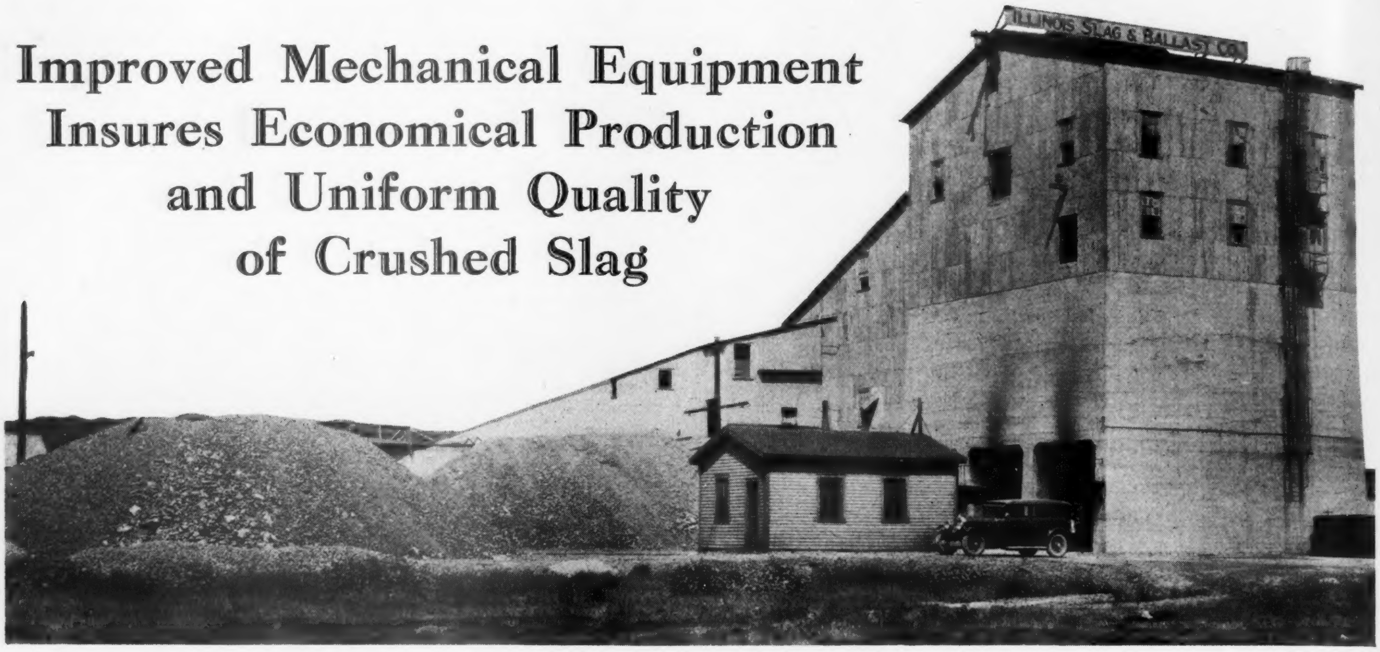
GRAND RAPIDS, Mich., has a new industry in the Sedlecky-Beneicke Co.

This enterprise is the only one of its kind in Michigan, except one in Detroit, and makes cast stone, ornamental plaster and does decorative designing. The company came here three months ago and its business is increasing.

Occupying a full subfloor and first floor quarters, the company now employs 12 men and expects to have 30 men on its payroll in a year. The firm is composed of Frank Sedlecky and a son, Arthur Sedlecky, formerly of Bellevue, and Richard Beneicke, modeler and designer, formerly of Detroit.

Most of the cast stone sold by the local company is used in buildings and includes window sills, columns, cornices, mantels and other units, such as gargoyles and roofing blocks. All of these are made in accordance with individual specifications. The company also is stocking a line of garden and park furniture, such as settees, sun dials and bird baths.—*Jackson* (Mich.) *Citizen-Patriot.*

Improved Mechanical Equipment Insures Economical Production and Uniform Quality of Crushed Slag



Plant of Illinois Slag and Ballast Co. at South Chicago, Ill. Chutes from magnetic separators have delivered the piles of reclaimed iron in foreground

High Intensity Magnetic Separation Process Removes Coke as Well as Iron from Finished Product at Illinois Slag and Ballast Co. Plant

By J. R. Armstrong*

VISITORS ENTERING CHICAGO by one of the southern routes may be astonished to suddenly look off to the east and see a low, rugged, dark mountain that is entirely incongruous with the level plains around the lower tip of Lake Michigan. In a second glance the observer notes that some one is already trying to cut the mountain down with a steam shovel. But even as the shovel tears away 30 tons or more of material, out rushes a locomotive pushing a long line of ladle-cars along the ridge. Presently the cars are dumped and the mountain grows. It is the slag pile of the Wisconsin Steel Works in South Chicago. For years the Illinois Slag and Ballast Co. has been removing tremendous tonnages of material annually, yet the pile continues to be of imposing proportions.

The idea of making additional use of slag that has already served one purpose in reducing iron ore to metal is not new, yet it still remains a very fascinating operation. The slag has uses similar to crushed stone, and ordinarily it has the advantage of a slightly lower selling price. Due to the fact that it is calcined in burning, and is 100% fireproof, it may even be regarded as superior to stone as an aggregate for reinforced-concrete building in cities.

*Russell T. Gray Co., Chicago, Ill.

Crushing Plant

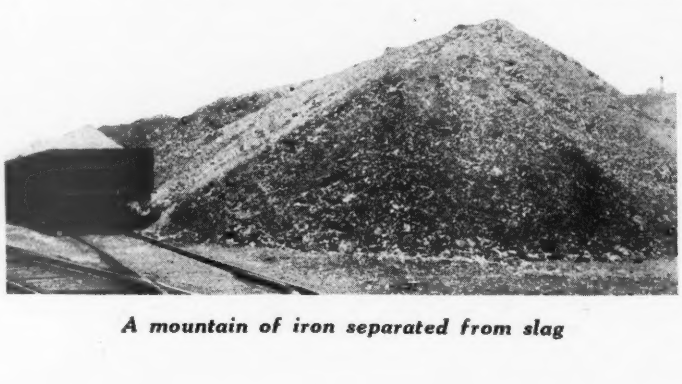
From the slag pile the Illinois Slag and Ballast Co. loads the material into one of two specially designed automatic, self-tripping dump cars which alternate in shuttling back and forth to the receiving hopper of the main crushing plant located about a quarter of a mile east of Torrence avenue at 99th street. Under this arrangement, one car is always ready for the steam shovel and the supply line can be kept moving continuously. A steam locomotive is used to move the supply cars.

These cars have a particularly interesting dumping arrangement. By means of a special tripper plate the car is positioned over the receiving hopper and all three drop-doors are released simultaneously. Another spring plate automatically closes the bottoms as the car leaves the plant, making it unnecessary for the operator of the engine to get out of the cab.

It is at the receiving hopper that the real processing work begins. Despite the fact that crushed slag is generally thought of as a raw product, here it is given as much care and inspection as any special sand or clay used by a potter. In fact, the slag is subjected to as thorough a process of magnetic separation as clay used by potteries. As a result of the emphasis which has been placed on the control of quality, this company finds it easy to meet the rigid specifications that apply to commercial slag ballast.

Iron Removal Profitable

As in many instances where the manufacturer pioneers in making quality a paramount requirement, high standards have repaid the Illinois Slag and Ballast Co. in several ways. First, a greater percentage of iron can be reclaimed for profitable resale; second, the separation of the iron from the slag reduces the possibility of damage or undue wear occurring in the crusher; and third, this reputation for high quality builds up profitable repeat business. Another favorable condition is that the use of dependable and complete mechanical equipment protects both the manufacturer and the customer from failures in production.



A mountain of iron separated from slag

In the first step of the processing work, the slag is fed down from the receiving hopper by a Webster reciprocating feeder. As the material passes

over the feeder apron an employe manually removes such large pieces of iron as the large skulls that have settled in the bottoms of the ladles. From here the slag drops on a 36-in. belt conveyor inclined at the unusually high angle of 22 deg. and running between 97 ft. 6 in. centers. The conveyor discharges to a short 48-in. belt on the third floor of the main crusher house. On this second conveyor there is a 42-in. by 48-in. Dings "high intensity" magnetic pulley.

This separator was designed to produce exceptionally high magnetic intensity, which renders it capable of removing not only iron but pieces of coke that have been impregnated with iron. Due to the light weight of the coke, only a small iron content is required to render it susceptible to this high intensity magnet.

Removing Iron Entrained in Slag

The slag is free from all iron except the small pieces entrained in the lumps of slag. From the magnetic pulley the material is discharged directly to a No. 7½ Austin gyratory crusher. After crushing it is carried to the top floor by a No. 8 Austin bucket elevator. Besides reducing the slag to a convenient size, the crushing frees small particles of iron from the center of large pieces of slag so that it can be removed by a second Dings magnetic separator, size 24-in. by 48-in., which is located at the head of a short belt conveyor above the screens.

All of the screens are of the vibrating type. By them the material is graded into the customary commercial sizes and delivered to the various storage bins on the second floor of the building. Vibration has been effectively confined solely to the screens by an ingenious arrangement of spring suspension; consequently a considerable portion of the noise and vibration noticed in the average screening plant is eliminated. Delivery of ballast for consumers can be made either to trucks or to traction cars run in on three lines of track directly under the storage bins. The plant is designed for a maximum production of 4500 cu. yd. daily.

At the present time a considerable proportion of the production goes to contractors in the Chicago area for use in concrete work. Local railroads and traction lines also find the material very successful for concrete aggregate and track ballast. An outlet for the fines is provided in high grade mastic roofing and similar work where fire resistance is important. Besides this, the Illinois Slag and Ballast Co. itself contracts for concrete work and thus becomes a consumer of a portion of the output. The company also owns a second slag crushing plant of similar design located at Joliet, Ill.

Trade Practice Conference, Concrete Mixer and Paver Industry

A TRADE PRACTICE CONFERENCE for the concrete mixer and paver industry was held at French Lick, Ind., September 5, 1929.

After the objects and purposes of the meeting were explained, the conference discussed and adopted 22 resolutions dealing with various trade or business practices. The Federal Trade Commission has reworded some of these resolutions and has divided them into Group I and Group II. Those in Group I the commission has approved, and those in Group II the commission has accepted as expressions of the trade. The commission declined to approve or accept Rules 13, 14, 16, 17 and 18 (Group II), as published November 21, 1929. It also declined to approve or accept resolutions 8, 9 and 17 as adopted by the industry.

The commission has directed that notice be given that in referring to or quoting trade practice conference rules the form in which they appear in the commission's official statement be followed with reference to wording, grouping, numbering and lettering.

Dissolution of Portland's Central Sand and Gravel Sales Company

By W. A. SCOTT

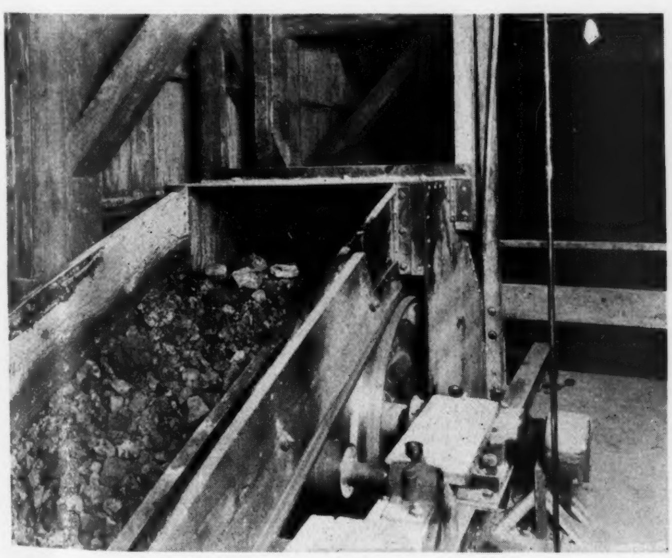
THE Central Sand and Gravel Co., Portland, Ore., which had functioned since July, 1928, as the selling agency for eight of the larger sand and gravel operators of that city, has been dissolved by the mutual consent of those member companies. Following this action each of the eight concerns resumed its former practice of selling material direct to the consumers.

The Central Sand and Gravel Co., during nearly three years of service as a selling agency, succeeded in stabilizing prices and effected some reduction in the overhead expenses of the companies that organized it. However, the prevailing light demands for mineral aggregates for all purposes were considered not sufficient to warrant continuing the selling agency.

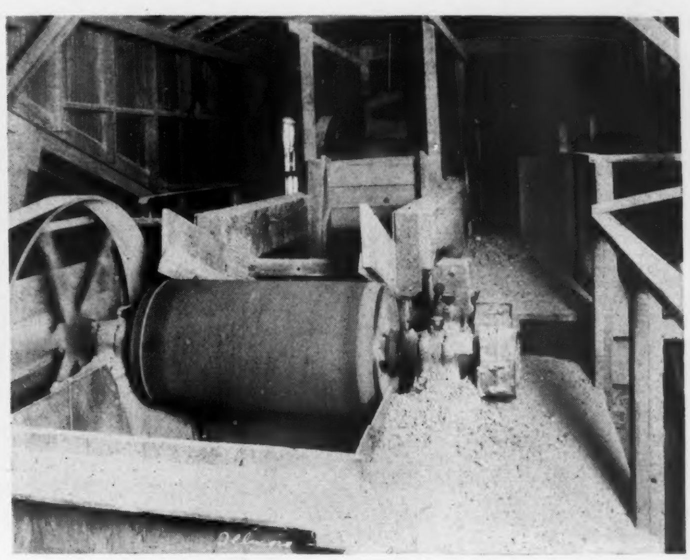
Price Reductions Followed Dissolution of Sales Company

Immediately following the dissolution of the Central company, there was a price decrease of 25 c. per cu. yd. in the Portland market, and further reductions are anticipated. The price cutting, of course, results from the decided slump in building and general construction which has continued for the last two years or more, and the keen competition for the business that is offered in connection with general building operations, street paving and highway work.

H. P. Warren, who was manager for the Central Sand and Gravel Co. during its period of activity, resumed his duties with the Portland Gravel Co., in which he is associated with Howard Puariea. This concern has long been active in the Portland district as a producer and wholesaler of sand and gravel, deriving its supplies from the Willamette and Columbia rivers.



The first magnetic separation is performed by this pulley at head of conveyor above rotary crusher

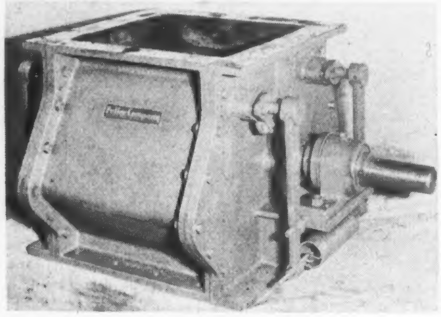


The second magnetic separation is accomplished by this pulley at head of elevator above the screens

New Machinery and Equipment

Rotary Feeder

A ROTARY FEEDER has been announced by the Fuller Co., Catasauqua, Penn. It is made in three standard sizes, each of which is said to have a wide capacity range by variation in speed to cover all of the normal requirements of the cement and allied industries.



Unique rapping method to prevent clogging

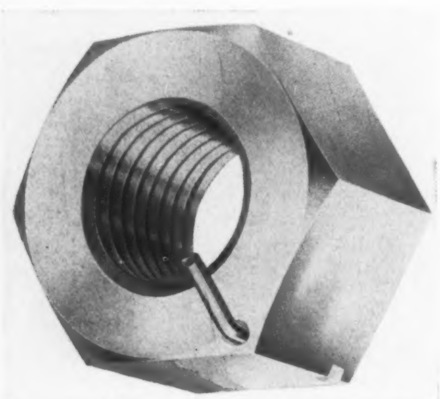
Features of the Fuller rotary feeder claimed by the manufacturers are that it does not flood when handling dry pulverized materials even though slides take place in the storage bin; it is volumetrically accurate and as the material is not wedged or packed during feeding, very close determinations can be made by weight; it is designed to operate at slow speeds; and the moving parts are protected by a liberal use of wear-resisting alloy.

A unique rapping device is said to provide uniform discharge of material and also to prevent clogging.

•

Safety Lock Nut

THE General Automatic Lock Nut Corp., New York, N. Y., has introduced a new nut which, it is said, cannot work loose. It is claimed to function like an ordinary nut but to be more simple and less expensive. The manufacturer also says no washers are needed.



Vibration tightens the grip

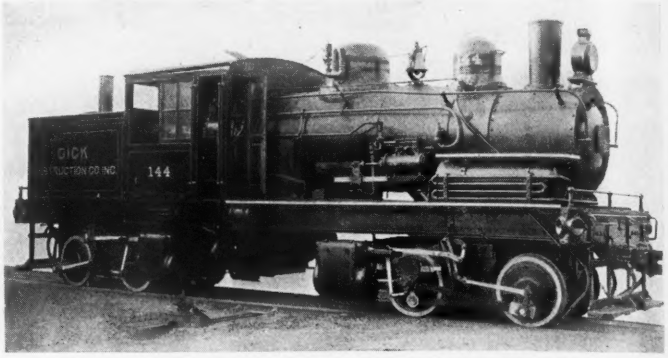
The locking is obtained by means of a pin inserted in the outer edge of the nut. The free end of the pin follows the thread of the bolt and establishes a point of impingement against it, biting in and thereby maintaining this point of adjustment against vibration and shock. To release the nut sufficient pressure is applied to the nut with a wrench to momentarily throw the pin, permitting it to pass over the bolt and eliminate the locking action while the nut is being removed or loosened. It is said this nut may be put on and removed repeatedly without damage to either pin, threads, nut or bolt.

Many applications are possible for this nut. At the present time it is being used by the G. H. Williams Co. on those parts of its clamshell bucket wherever it is applicable.

•

Steam Locomotive

THE Vulcan Iron Works, Wilkes-Barre, Penn., has developed a new type of locomotive, said to be the first of its kind built in America. This Vulcan "Duplex" locomotive was recently completed and is now in service.



Two swiveling trucks help negotiate sharp curves

The builders claim that trackage expense and upkeep in the stripping field will be materially reduced with this design.

This new design is said to meet the demand for a comparatively heavy steam locomotive by distributing the weight over a greater length of rail, thus making it adaptable to the handling of heavy loads on steep grades with sharp curves on poorly laid track. It has two swiveling trucks, which are said to enable it to negotiate sharp curves and provide for traction on poorly constructed roadbeds.

The locomotive illustrated weighs 55 tons, with the weight distributed over eight driving wheels. The 8-wheel arrangement consists of 2 four-wheel swiveling trucks, each having a pair of 13-in. by 10-in. piston valve type cylinders, with valves controlled by Walschaert gear. Each truck is said to be a complete unit in itself and obtains its steam through flexible connections from the boiler.

The main locomotive frame is of structural steel design. The boiler is of extended wagon top type with charcoal iron tubes. It gets its water supply from the rear tank by means of a feed pump and also an injector. The working pressure is 200 lb. Space is provided for approximately 5000 lb. of coal.

The locomotive is equipped with Westinghouse air-brake apparatus. The sanding arrangement is controlled by air or hand.

The reversing of the locomotive is effected by a Ragonnet reverse gear.

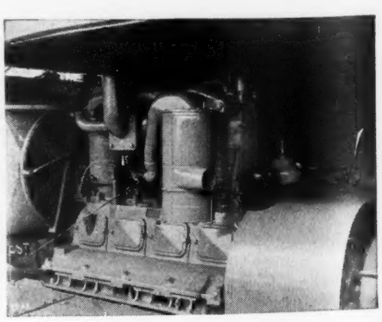
According to the manufacturer preliminary tests developed tractive effort of upwards of 30,000 lb. A feature of the locomotive is said to be the steam control. By means of a special arrangement in the steam line, both trucks may be operated simultaneously or the steam to either truck may be partly or completely shut off to prevent slipping of wheels.

The manufacturer intends to further develop this design into a range of sizes to meet all industrial haulage requirements.

•

Carburetion Development

THE Northwest Engineering Co., Chicago, Ill., has announced a new advance in carburetion. This consists of a new modern



Designed for fuel economy

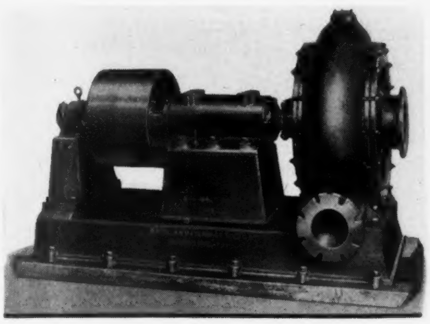
type carburetor and hand idling control. Its use is said to provide greater power, particularly at low speeds in hard pulling; to give more responsive throttle opening; to give steady operation at part throttle and governor idle speeds; and better fuel economy.

According to the manufacturer, reports from users have shown savings in some cases as high as ten gallons a day. For the present it is applied only to the larger engines of the Northwest line.

•

Abrasive Materials Pump

THE American Manganese Steel Co., Chicago Heights, Ill., has recently added a new managanese steel pump known as the new Type "C" to its line of abrasive materials handling pumps.



Bearing arrangement absorbs shocks

It is said many new features have been included in these pumping units, among which are the following: bearings are interchangeable in the field, either sleeve or antifriction types being available; lubrication is required only on main bearings (except where outboard bearings are used); impeller clearance and main bearings can be adjusted easily without dismantling; and thrust and radial shocks are completely absorbed by new bearing arrangement.

•

Pumping Unit

THE Monobloc Type D centrifugal pump has recently been placed on the market by the Worthington Pump and Machinery Corp., Harrison, N. J.

Bronze impeller incorporates shaft sleeve as integral part

The pump is bolted to the extended motor frame and the impeller is mounted on the end of the continuous motor shaft. The bronze impeller is said to incorporate the shaft sleeve as an integral part, a recent development for shaft protection. The special cadmium-plated steel locking device for the impeller, the forged bronze packing gland and the arrangement of shaft water-throwers, are said to be other features of this pump.

A ball bearing Masterbilt motor of standard electrical construction is used.

This unit is said to be adaptable to general service.

•

Insulating Firebrick Announced

THE BABCOCK AND WILCOX CO., New York, N. Y., announces a new insulating firebrick known as the B. & W. No. 80.

The No. 80 brick is said to be not only an insulator but a firebrick as well.

The accompanying curve shows the thermal conductivity of B. & W. No. 80 insulating firebrick compared with that of several other insulators.

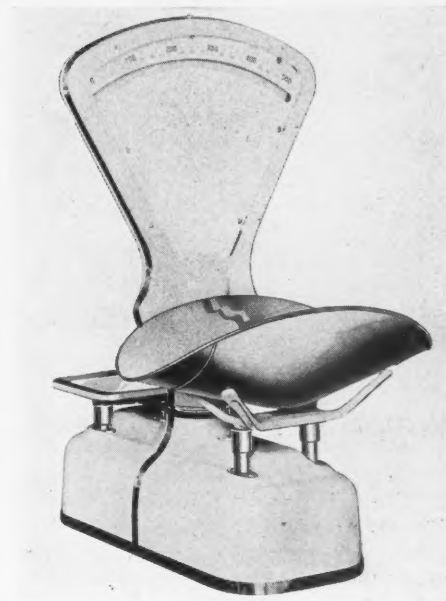
It is said the brick may be used without a facing of firebrick on the furnace side, exposed to furnace temperatures and gases and protected only by a coating of No. 80 high temperature or patching cements.

The brick is said to be suitable for lining oil- and gas-fired furnaces, electric furnaces of the resistance type and for coal-fired equipment wherever it may be used in protected wall areas not exposed to mechanical abrasion and slag action. The manufacturer states these bricks are easy to handle and may be cut, drilled or shaped with ordinary woodworking tools.

•

Laboratory Scale

A LABORATORY SCALE, said to be designed to permit close reading without the use of extended beam equipment, has recently been announced by the Toledo Scale Co., Toledo, Ohio.

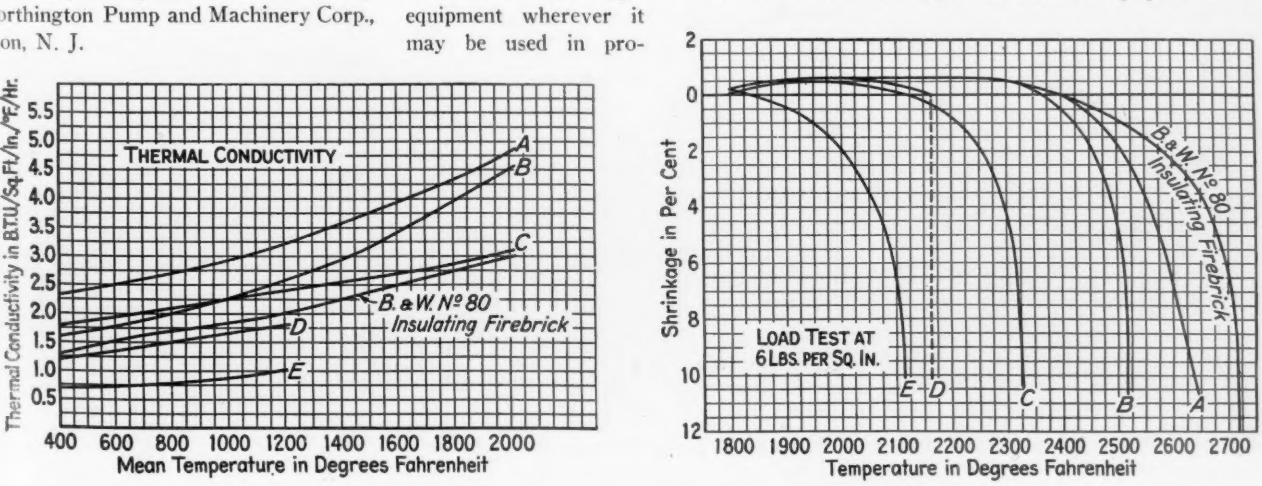


Has capacity of 5 kg.

The chart on this scale has a capacity of 500 g., with a mark and figure for each gram. It also shows the avoirdupois equivalents. Additional capacity up to 5 kg. may be secured by the use of weights.

The chart housing may be set at any angle, and the scale comes equipped with either a pan, platter or scoop as the purchaser desires.

This scale is said to enable weighing ingredients accurately, to the gram, in approximately one-quarter the time consumed with balance equipment.

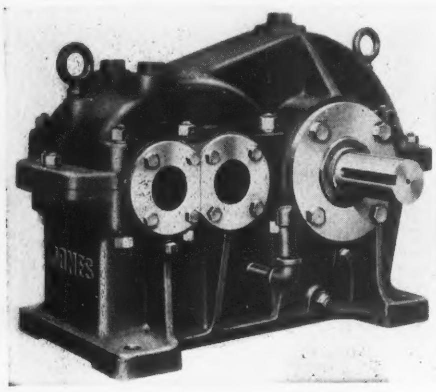


Conductivity and shrinkage of new firebrick at various operating temperatures

Reducers for Small Motor Drives

ANNOUNCEMENT is made by the W. A. Jones Foundry and Machine Co., Chicago, Ill., on its new double reduction Herringbone-Maag speed reducers for small motor drives. In design, construction and manufacture, these small machines are said to be the same as the heavy duty reducers.

Double helical gears, generated right and



Double helical gears used for initial reduction

left hand, are used for the initial, or high speed, reduction, according to the manufacturer. The low speed reduction consists of a generated Maag pinion and gear. Timken bearings are said to be used throughout.

Ratio Meter

THE Bailey Meter Co., Cleveland, Ohio, announces the Bailey ratio meter for use as a combustion guide in the firing of gas or oil fired heaters, kilns, and industrial furnaces.

May be used as fluid meter on fuel line

The primary purpose of the Bailey ratio meter is said to be to provide furnace operators with guide which will enable them to maintain a definite relation between the amounts of air and fuel supplied to the furnace. The meter contains two recording pens. One records the rate of oil flow. The other pen records the flow of air to the furnace.

At the time the meter is installed, a complete combustion test is run on the furnace to determine what ratio between air flow and fuel flow corresponds to best combustion conditions, and the air flow mechanism is then adjusted so that this ratio is always obtained when the two records coincide, one upon the other. According to the manufacturer, the furnace operator, therefore, merely has to keep the two pens together by proper manipulation of the air supply to be assured that maximum operating economy is secured.

In addition to serving as a combustion guide, the Bailey ratio meter is said to be valuable as a fluid meter on the fuel line. Thus the meter is said to furnish daily graphic pictures of furnace operation and supplies data for cost accounting systems.

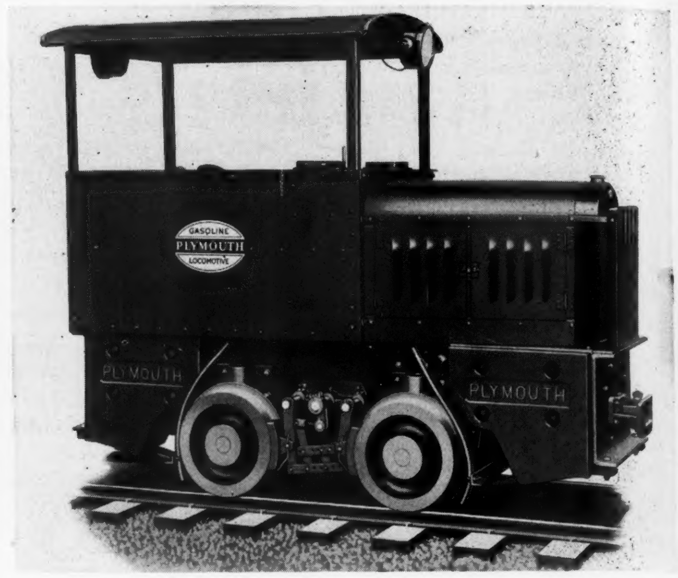
According to the manufacturer, the Bailey ratio meter has been so designed that it is possible to install auxiliary recorders of temperature or pressure when advantageous, to give records of these factors on the same chart with the flow records. Each factor is recorded in an individual color so that it can be distinguished from other records.

Gasoline Locomotive

TO MEET THE REQUIREMENTS of those having a light haulage problem, a new model gasoline locomotive equipped with Ford engine and 4-speed truck transmission has been announced by the Fate-Root-Heath Co. (Plymouth Locomotive Works), Plymouth, Ohio.

It is built in four weights—2½, 3, 3½ and 4 tons—on a short wheel base to negotiate sharp curves. It is suitable for use in quarries, sand, gravel and clay plants and for general industrial haulage.

A Plymouth reversing transmission, connected by a shaft and universal joints to the Ford 4-speed truck transmission, provides four speeds in either direction.



Has four-speed truck transmission

The side frames, bumpers and cross supports are said to be of heavy structural and bar steel, well braced and rigidly riveted and welded together.

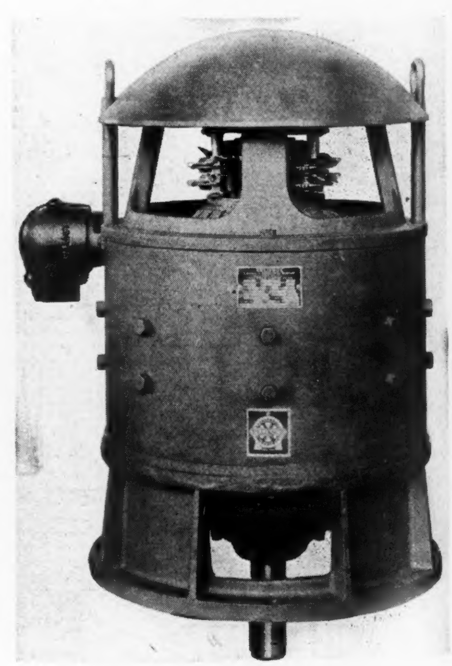
Standard equipment provides electric starter, generator, headlights, horn and oil-moistened air cleaner.

Vertical Direct-Current Motors

THE Reliance Electric and Engineering Co., Cleveland, Ohio, has developed Type T direct-current motors for vertical operation in sizes up to 50 hp.

These motors are said to be provided with a ring base for mounting and a drip cover to protect them from falling dirt and chips and from dripping water, oil or other injurious solutions.

Where it is desirable the motor can be mounted direct to the driven machine.



Made in sizes to 50 hp.

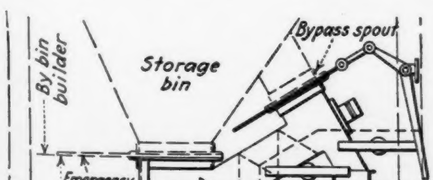
Automatic Scale for Weighing Bulk Cement

BATCHING loose or bulk cement from a storage bin within a tolerance of ½ of 1% is the function of the duoscrew feed automatic scale manufactured by the Richardson Scale Co., Clifton, N. J. The device is made up of a structural steel framework supporting a dual-screw feeding system with complete individual motor drives, automatic scale weighing levers, a beam box, a weighing hopper and a lower shroud. It is said to be designed for rapid removal and transportation from one location to another, and is arranged to occupy space beneath a standard cement bin.

The weighing mechanism is housed in a beam box of channel and sheet iron, with a hinged cover which can be locked during operation.

Cement flows from the storage bin through an 18x18-in. main inlet opening to two screw conveyors arranged side by side. These consist of a standard 9 in. screw conveyor and a half-pitch 6 in. conveyor. Each screw is driven by an individual motor through a speed-reducing unit, current to the motors being controlled through both a pushbutton operator's switch and heavy-duty mercury switches operated by the main weighing feed. When the weighing hopper is empty and the poise weights are placed in weighing position, the pushbutton starts both motors and the weighing cycle begins. When approximately 70% of the load has entered the weighing hopper, the beam automatically tilts a mercury switch and stops the 9-in. screw conveyor. The smaller conveyor completes the batch and is shut off by a second mercury switch when the proper weight of cement has been delivered. With an adequate head of cement maintained in the storage bin, the outfit is said to be capable of completing two weighings per min. with batches ranging from 400 to 1,000 lb.

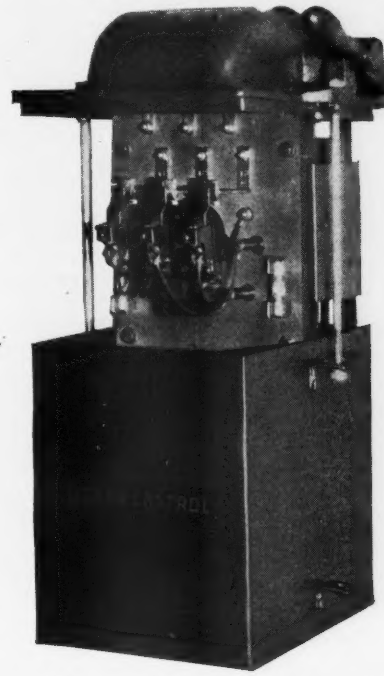
For emergency operation in case of power failure, a bypass inlet chute with hand-controlled slide type cutoff gate connects the storage bin directly with the weighing hopper.



Mercury switch automatically controls screw feed

Small Motor Safety Switch and Magnetic Contactor

THE Rowan Controller Co., of Baltimore, Md., recently introduced a combination safety switch and magnetic contactor for use with small alternating current motors.



Unit is completely oil immersed

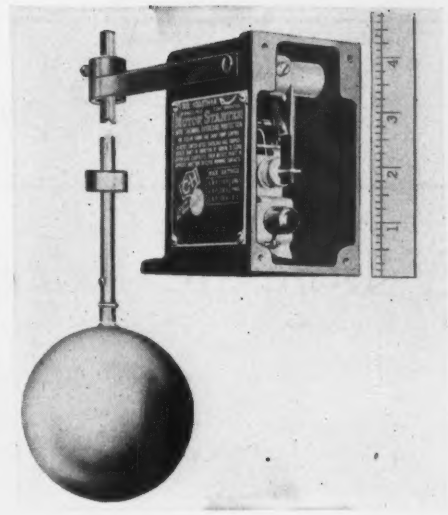
The equipment can be furnished up to and including 5-hp., 220, 440 or 550 volt.

The unit is said to be compactly built, so that it occupies a minimum wall space and the fact that it is completely oil immersed is said to make it vapor-proof, weather-proof and dust-tight.

Float-Operated Motor Starter

FOR small alternating current and direct current motors on drains, sump pumps, open tanks and similar application, the new float operated motor starting switch announced by Cutler-Hammer, Inc., Milwaukee, Wis., is said to provide across-the-line starting and thermal overload protection. For larger motors this same device can be provided without overload protection so it can be used as a master switch in the control circuit of a separate automatic starter. It can also be furnished without the float accessories for use as a lever operated master switch.

According to the manufacturer, the thermal overload relay protects the motor from burnout and prevents unnecessary blowing of fuses. It is free tripping—the switch cannot be held closed on an overload. When the overload trips, it is necessary for someone to go to the switch and return the operating lever to the full "off" position to reset the overload.



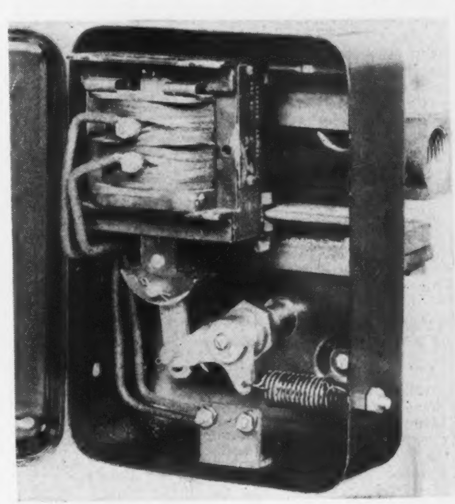
Has thermal overload protection

Solenoid-Operated Valve

A SOLENOID-OPERATED valve, designated CR-9507-A1, for controlling liquids and gases under pressure has been announced by the General Electric Co., Schenectady, N. Y. Some of the uses for which the new valve is designed are for operating steam or air whistles, for remotely or automatically controlling the supply of oil or gas to furnaces and for controlling the flow of water in jackets on compressors.

The gland connected to the operating mechanism is of the rotary type.

It is said the valves can be made normally open or normally closed in the field by drilling the mounting holes in the case and transferring the solenoid and operating mechanisms to the opposite side. The valves are of the unbalanced type and require little power for operation. A standard solenoid is used. All of the coils are designed for continuous duty and the solenoids are selected to provide ample operating power.



To control liquids or gases under pressure

The Rock Products Market

Wholesale Prices of Aggregates

(F.O.B. Plant or City Designated)

Prices given are for crushed limestone per ton, unless otherwise stated

	Crushed stone: Screenings, ¼ in. down	Crushed stone: ½ in. and less to 2½ in.	Sand ¼ in. and less	Gravel, ½ in. and less to 2 in.	Slag: Screenings, ¼ in. down	Slag: Crushed, ½ in. and less to 3 in. and larger
EASTERN:						
Albany, N. Y.			.70	1.00		
Bethlehem, Penn.					.50– .60	.50–1.10
Birdsboro, Penn. (trap rock)	2.10	2.20–2.50				
Boston, Mass. (g)			1.15	1.75		
Buffalo, N. Y.					1.50d	1.50–1.60d
Clarence, N. Y.			1.00–1.10	1.00–1.10		
Erie and Du Bois, Penn.					1.50	1.50–1.60
Hillsville, Penn.	.85	1.35				
Montoursville, Penn.			.70–1.00	.40– .50		
New York City			1.00	1.50		
Oriskany Falls, N. Y.	.50–1.00	.80–1.25				
Philadelphia, Penn. (a) (trap rock)	3.45–5.70	3.45	1.40–1.50	1.95–2.20		2.95
Rochester, N. Y.			1.40	1.40		
Washington, D. C.			.85	1.30		
CENTRAL:						
Alton, Ill.	1.75	1.75				
Chicago, Ill.			.90–1.00	.95		
Columbus, Ohio			.75d	.75d		
Dubuque, Iowa	1.00	1.00–1.10				
Eau Claire, Wis.			.40	.50– .85		
Grand Rapids, Mich.			.40– .50	.60– .70		
Greenbush, Mich.			.40	.70m		
Hannibal, Mo.¶	1.40	1.40				
Indianapolis, Ind.			.36– .54	.54– .63		
Maplewood, Mo. (e)	1.25	1.25				
Merom, Ind.			.40– .60	.60– .70		
Milwaukee, Wis.	1.14	1.24	1.15–1.60	1.15–1.60		
Stone City, Iowa	.75	1.00–1.10f				
St. Louis, Mo.			.70	1.10–1.25		
St. Paul, Minn.	.50	1.15	.35	1.15		
Toledo, Ohio	1.10	1.60			1.00	1.10
Waukesha, Wis.	1.90	1.90	1.45	1.60–1.65		
SOUTHERN:						
Atlanta, Ga. (granite)	1.20	1.50–1.60				
Birmingham, Ala.					.55‡	.80–1.25
Columbia, S. C. (granite)		1.40–1.60f				
Ensley and Alabama City, Ala.					.55	.80–1.25
Fort Spring, W. Va.	.35	1.00–1.35				
Fort Worth, Tex.			1.00	1.25		
Houston, Tex.			1.25*	1.95k		
Knoxville, Tenn.			.75– .85	1.20–1.50		
Longdale, Va.					.75	1.05–1.25
Montgomery, Ala.			.25– .35	.50– .60		
Tyrone, Ky.	.50– .90	.50–1.25				
WESTERN:						
Denver, Colo.			1.25–1.35	1.90–2.10		
Long Beach, Calif.			1.90	2.50		
Los Angeles, Calif. (h) (granite)		2.10	1.00–1.80	1.50–2.50		
Phoenix, Ariz.			1.65–1.75*	1.50–2.00*		
Salt Lake City, Utah			.60	.60n		
San Francisco, Calif. (Bay points) (j)	1.45	1.45	1.45	1.45		
Seattle, Wash.			1.25*	1.25*		
Spokane, Wash.			1.00–1.50	1.25–1.75		
Tulsa, Okla.	.70	1.05–1.35				

*Prices per cu. yd. ¶F.o.b. cars. †Less 10c per ton monthly settlements disc. ‡Prices less 5c disc. per ton for payment 15th following month. (a) Consumer prices subject to cash disc. of 10c per ton. (b) ½ in. to 1½ in. (c) 1½ in. and less. (d) F.o.b. trucks at plant. (e) Delivered in truck loads. (f) ¾ in. to 2½ in. (g) Delivered to job by truck, Boston. (h) F.o.b. job site via motor truck. (j) Fine sand, 1/10in. down, per ton, 1.85. (k) Less 10c cash disc. (m) 2-in. and less. (n) 1-in. to 2-in.

Mica

Prices given are net, f.o.b. plant or nearest shipping point.

Martinsville, Va.—Mine scrap, per ton, 16.00–20.00; mica schist, per ton	12.00
Franklin, N. C.	
Mine scrap, per ton, f.o.b. mine	15.00
Mine run, per ton, f.o.b. mine	10.00
Clean scrap for wet grinding, per ton, f.o.b. mine	20.00
Ground mica, per ton at mill, 20 mesh, 25.00; 40 mesh, 30.00; 60 mesh, 35.00; 100 mesh	50.00
Roofing mica, per ton at mill, schist, 17.00; white	30.00
Punch, per lb.	.05

Roofing Slag

Prices given are per ton f.o.b. city named, unless otherwise noted.

Bethlehem, Penn.	1.00–1.50‡
Birmingham, Ala.	2.05*
Buffalo, N. Y.	2.50†
Ensley and Alabama City, Ala.	2.05
Erie and Du Bois, Penn.	2.50†
Longdale, Va.	2.50
Toledo, Ohio	1.10

*Less 5c ton disc. for pay. 15th following month. †Price f.o.b. trucks at plant, subject to discount of 10c per ton for payment on or before the 15th of following month. ‡F.o.b. plant.

Agricultural Limestone

(Crushed)

Alton, Ill.—90% thru 100 mesh	4.50
Cape Girardeau, Mo.—Analysis, $CaCO_3$, 94½%; $MgCO_3$, 3½%; 90% thru 50 mesh	**1.50**
Cartersville, Ga.—50% thru 50 mesh, per ton, 1.25; pulverized limestone	2.00
Colton, Calif.—Analysis, 95.97% $CaCO_3$; 1.31% $MgCO_3$ all thru 14 mesh down to powder	3.50
Davenport, Iowa — Analysis, 92-98% $CaCO_3$; 2% and less $MgCO_3$; 100% thru 4 mesh, 50% thru 20 mesh; bulk	**1.10**
Dolomite, Calif.—Analysis, 54% $CaCO_3$; 45% $MgCO_3$; 99% thru 10 mesh, per ton, 2.10; 49% thru 60 mesh, ¼-in. to dust, per ton	**1.70**
Fort Spring, W. Va.—Analysis, 90% $CaCO_3$; 3% $MgCO_3$, 50% thru 100 mesh, per ton	1.35
Gibsonburg, Ohio—Analysis, 55% $CaCO_3$; 43.40% $MgCO_3$; 50% thru 50 mesh, 1.25; pulverized, bulk, 3.00; in bags	4.50
Hillsville, Penn.—Analysis, 94% $CaCO_3$, 1.40% $MgCO_3$, pulverized, in bags, 4.50, bulk	3.00
Knoxville, Tenn.—80% thru 100 mesh, bulk 2.00, in bags, per ton	3.25
Lannon, Wis.—50% thru 100 mesh	1.50
Marion, Va.—Analysis, 90% $CaCO_3$, per ton	2.00
Middlebury, Vt.—Analysis, 99.05% $CaCO_3$; 90% thru 50 mesh	4.25
Osborne, Penn. — Analysis, 94.89% $CaCO_3$, 1.50% $MgCO_3$; 100% thru 20 mesh; 60% thru 100 mesh and 45% thru 200 mesh, per ton, f.o.b. mine	3.50
Stone City, Ia.—Analysis, 98% $CaCO_3$; 50% thru 50 mesh	.75
Waukesha, Wis.—90% thru 100 mesh, 4.10; 50% thru 100 mesh, per ton	2.10

Pulverized Limestone for Coal Operators

Davenport, Ia.—Analysis, 92-98% $CaCO_3$; 2% and less $MgCO_3$; 100% thru 20 mesh, 50% thru 200 mesh; sacks, ton	6.00
Joliet, Ill.—Analysis, 48% $CaCO_3$; 42% $MgCO_3$; 90% thru 200 mesh (bags extra)	3.50
Waukesha, Wis.—90% thru 100 mesh	4.10

Chicken Grits

Chico, Tex.—(Limestone) packed in 100-lb. sacks, per cwt., f.o.b. cars at plant	1.00
Davenport, Iowa—High calcium carbonate limestone, in bags, L.C.L., per ton	6.00
Gibsonburg, Ohio—(Agstone)	**10.00**
Los Angeles, Calif.—(Gypsum), per ton, including sacks	7.50– 9.50
Marble grits, per ton, incl. sacks	10.00–12.50
Maplewood, Mo.—(Limestone), per ton	12.00
Middlebury, Vt.—Per ton (a)	10.00
Port Clinton, Ohio—(Gypsum), per ton	6.00
Randville, Mich.—(Marble), per ton, bulk	6.00
Saltville, Va.—(Gypsum) in 100-lb. jute sacks, per ton	12.00
Waukesha, Wis.—(Limestone), per ton	7.00

(a) F.o.b. Middlebury, Vt. ¶C.L. ‖L.C.L.

Fullers Earth

Prices per ton in carloads, f.o.b. Florida shipping points. Bags extra and returnable for full credit.

16– 30 mesh	20.00
30– 60 mesh	22.00
60–100 mesh	18.00
100 mesh and finer	9.00
Joliet, Ill.—All passing 100 mesh, f.o.b. Joliet, incl. cost of bags	24.00

Portland Cement

	F.o.b. city named Per Bag	Per Bbl.	High Early Strength
Atlanta, Ga.	....	†1.87	2.92¶
Baltimore, Md.	....	1.57†	2.17¶
Birmingham, Ala.	....	†1.56	2.61¶
Buffalo, N. Y.	....	1.30†	2.20¶
Charleston, S. C.	....	1.89†	2.94¶
Chicago, Ill.	....	1.35†	2.11¶
Cincinnati, Ohio	....	1.23†	2.16¶
Cleveland, Ohio	....	......	2.34¶
Columbus, Ohio	....	......	2.26¶
Dallas, Tex.	....	1.76	2.81¶
Dayton, Ohio	....	......	2.19¶
Detroit, Mich.	....	......	2.30¶
Houston, Tex.	....	1.98	3.03¶
Jackson, Miss.	....	†1.94	2.99¶
Jacksonville, Fla.	....	†1.96	3.01¶
Indianapolis, Ind.	....	1.39†	2.04¶
Jersey City, N. J.	....	1.59†	2.09¶
Kansas City, Mo.	.31¾	1.27†	......
Louisville, Ky.	....	1.41†	2.09¶
Memphis, Tenn.	....	†1.73	2.78¶
Milwaukee, Wis.	....	1.45†	2.20¶
Montreal, Que.	....	1.66§	......
New Orleans, La.	....	1.86†	2.96¶
New York, N. Y.	....	1.49†	2.09¶
Philadelphia, Penn.	....	1.51†	2.11¶
Pittsburgh, Penn.	....	1.46†	2.15¶
Portland, Ore.	....	2.40	......
Reno, Nev.	....	2.76‡	......
St. Louis, Mo.	....	1.20†	2.09¶
San Francisco, Calif.	....	2.04‡	......
Savannah, Ga.	....	1.89†	2.94¶
Seattle, Wash.	....	2.20–2.45	2.75c
Tampa, Fla.	....	2.00†	3.16¶
Toledo, Ohio	....	......	2.28¶
Topeka, Kan.	.37½	1.50†	......
Wheeling, W. Va.	....	1.42†	2.11¶

Mill prices f.o.b. in carload lots, without bags, to contractors.

Davenport, Calif.	....	1.85	......
Lime & Oswego, Ore.	....	2.40	......
Limedale, Ind.	....	1.10†	......

NOTE: Unless otherwise noted, prices quoted are net prices, without charge for bags. Add 40c per bbl. for bags. †Includes 10c cash disc. ‡Subject to 2% discount payment 10th of month following invoice date. ¶"Incor" Perfected, prices per bbl. packed in paper sacks, subject to 10c discount 15 days. (c) Quick-hardening "Velo," packed in paper bags. 10c discount 10 days. §Sales tax included at 4%.

Masonry Cement

The prices shown here are for various brands of masonry and mortar cement, including cost of bags.

	Per bag	Per bbl.
Cincinnati, Ohio	†.38½	†1.54
Columbus, Ohio	†.40¼	†1.61
Dayton, Ohio	†.39	†1.56
Detroit, Mich.	†.41¾	†1.67
Indianapolis, Ind.	†.37½	†1.50
Louisville, Ky.	†.35½	†1.42
Memphis, Tenn.	†.43½	†1.74
Norfolk, Va.	†.49½	†1.98
St. Louis, Mo.	†.40¾	†1.63
Toledo, Ohio	†.41	†1.64
Winston-Salem, N. C.	†.46½	†1.86

†Packed in paper sacks; price includes cost of sacks, and is subject to 10c bbl. discount for payment in 15 days.

Rock Phosphate

Prices given are per ton (2240 lb.) f.o.b. producing plant or nearest shipping point.

Lump Rock

Gordonsburg, Tenn. 4.25– 4.75
Mt. Pleasant, Tenn.:
B.P.L. 76% 6.25

Ground Rock
(2000 lb.)

Gordonsburg, Tenn. 5.25– 6.00
Mt. Pleasant, Tenn.—(Lime phosphate) —B.P.L. 74-75%, 80 to 90% thru 300 mesh; per ton, bags extra 12.80
Ground rock, B.P.L. 72%, per ton 5.00

Florida Phosphate
(Raw Land Pebble)

Mulberry, Fla.—Gross ton, f.o.b. mines

68/66% B.P.L.	3.15
70% minimum B.P.L.	3.75
72% minimum B.P.L.	4.25
75/74% B.P.L.	5.25
77/76% B.P.L.	6.25

Glass Sand

(Silica sand is quoted washed, dried and screened)

Klondike, Mo.	2.00
Ohlton, Ohio	2.35
Ottawa, Ill.	1.25

Miscellaneous Sands

City or shipping point	Roofing sand	Traction
Eau Claire, Wis.	......	.50
Ohlton, Ohio	1.40	1.40

Core and Foundry Sands

Silica sand quoted washed, dried, screened unless otherwise stated; lowest net prices per ton f.o.b. plant

City or shipping point	Molding Fine	Molding Coarse	Molding Brass	Core	Furnace lining	Sand blast	Stone sawing
Albany, N. Y.	2.00	2.00	2.25	......	......	3.25	......
Columbus, Ohio	1.50	1.50	......	......	......	3.50	......
Eau Claire, Wis.	......	......	......	......	......	2.00b	......
Elco, Ill.	Amor. silica, 90-99½% thru 325 mesh, $10.00						
Montoursville, Penn.	......	......	......	1.50a	......	......	......
New Lexington, Ohio	2.00	1.25	......	......	......	......	......
Ohlton, Ohio	1.40	1.50	......	1.40	1.40	1.40	......
Ottawa, Ill.	......	......	......	......	......	3.50	......
South Vineland, N. J.	Washed silica, 1.50 per ton; dry white, 2.00 per ton						

*Damp. (a) To 1.60. (b) To 2.50.

Wholesale Prices of Slate

Lowest prices f.o.b. at producing point or nearest shipping point

Slate Flour

Pen Argyl, Penn.—Screened, 200 mesh, 6.00 per ton in paper bags

Roofing Slate

Prices per square—Standard thickness

City or shipping point	3/16-in.	¼-in.	⅜-in.	½-in.	¾-in.	1-in.
Bangor, Penn.—						
Gen. Bangor No. 1 clear	10.00	20.00	25.00	29.00	40.00	50.00
Gen. Bangor No. 1 ribbon	9.00	16.00	20.00	25.00	35.00	46.00
No. 1 Albion	7.25	16.00	23.00	27.00	37.00	46.00
Gen. Bangor No. 2 ribbon	6.75	....	....	....	....	....
Chapman Quarries, Penn.—						
No. 1 slate	....	12.50	18.00	21.50	25.00	30.00
Hard vein	9.00–11.00	15.00	22.00	26.50	32.00	37.00
No. 2 slate	8.00– 9.00	....	....	....	....	....
Pen Argyl, Penn.*						
Graduated slate	....	16.00	23.00	27.00	37.00	46.00

Albion blue-grey roofing slate, No. 1 clear 7.25–10.50, mediums 8.00–9.00; No. 1 ribbon, 8.00–8.50.
*2% discount for payment 15 days from date of invoice.

(a) Prices are for standard preferred sizes (standard 3/16-in. slates), smaller sizes sell for lower prices.
(b) Prices other than 3/16-in. thickness include nail holes.
(c) Prices for punching nail holes, in standard thickness slates, vary from 50c to $1.25 per square.

Special Aggregates

Prices are per ton f.o.b. quarry or nearest shipping point.

City or shipping point	Terrazzo	Stucco-chips
Brandon, Vt.—English pink, cream and coral pink	¶12.50–‖14.50	¶12.50–‖14.50
Cardiffe, Md.—Crushed green marble	12.50– 14.50	12.50– 14.50
Davenport, Ia. — White limestone, in bags, ton	‖6.00	‖6.00
Los Angeles, Calif.—(a)		
White	¶11.00–‖13.50	¶11.00–‖13.50
Snowflake	....	¶11.00–‖13.50
Golden, browns, grey, blues, blacks	¶16.00–‖18.50	¶16.00 ‖18.50
Dolomite, Calif. (Lone Pine)—(a)		
White	¶8.80– ‖8.80	¶8.80– ‖8.80
Snowflake	....	¶8.80– ‖8.80
Golden, browns, grey, blues, blacks	¶13.80–‖13.80	¶13.80–‖13.80
Middlebrook, Mo.—Red	....	20.00– 25.00
Middlebury, Vt.—White	....	¶9.00–‖10.00
Randville, Mich.—Crystalite, crushed white marble, bulk	4.50	4.50– 5.00
Tuckahoe, N. Y.	¶5.00– ‖6.00	....
Warren, N. H.	....	¶7.00– 11.25

¶C.L. ‖L.C.L. *Per 100-lb. (a) Including bags.

Art and Cast Stone Aggregates

Cardiffe, Md.—Green marble fines in carloads; bulk, 7.50; in bags 10.00
Los Angeles, Calif.—Dolomite aggregates, all sizes and colors† .... ¶10.00 ‖12.50
Dolomite special cast stone, wet-cast aggregate, white, ¼-in. to dust a5.30

† 100-lb. sacks. ¶C.L. ‖L.C.L. (a) In open cars.

Talc

Prices given are per ton f.o.b. (in carload lots only), producing plant, or nearest shipping point.

Chester, Vt.—Finely ground talc (carloads), Grade A—99-99¾% thru 200 mesh, 8.00–8.50; Grade B, 97-98% thru 200 mesh 7.00– 7.50
1.00 per ton extra for 50-lb. paper bags; 166⅔-lb. burlap bags, 15c each; 200-lb. burlap bags, 18c each. Credit for return of burlap bags. Terms 1%, 10 days.

Emeryville, N. Y.:
Ground talc (200 mesh), bags 13.75
Ground talc (325 mesh), in bags 14.75

Henry, Va.:
Crude (mine run), bulk 3.50– 4.00
Ground talc (150-200 mesh), in bags 4.80– 9.00

Joliet, Ill.:
Ground talc, 200 mesh, in bags:
California talc 30.00
Southern talc 20.00
Illinois talc 10.00

ROCK PRODUCTS solicits volunteers to furnish accurate price quotations.

Lime Products

(Lowest carload prices per ton f.o.b. shipping point unless otherwise noted)

	Finishing hydrate	Masons' hydrate	Agricultural hydrate	Chemical hydrate	Ground burnt lime, Bulk	Ground burnt lime, Bags	Lump lime In bulk	Lump lime In bbl.
EASTERN:								
Berkeley, R. I.	....	11.25	9.50	....	....	15.50	....	19.25
Buffalo, N. Y.	7.00	5.50	5.50	11.50	6.00	8.00	6.00	....
Cedar Hollow, Devault, Rambo and Swedeland, Penn.	....	8.50c	8.50c	8.50c	7.00	8.50	8.50	....
Lime Ridge, Penn.	....	....	8.00	....	6.00	7.00	4.50	....
CENTRAL:								
Cold Springs, Ohio	....	5.50	5.50	....	....	....	6.00	....
White Rock, Gibsonburg, Marblehead, Ohio, and Huntington, Ind.	7.00*	5.50	5.50	11.50	6.00	8.00	6.00	....
Delaware, Ohio	7.00	5.50	5.50	6.50	....	....	5.00	....
Tiffin, Ohio	....	....	....	....	6.00	8.00	....	....
Woodville, Ohio	7.00	5.50	5.50	9.00	6.00	8.00	6.00	14.00
SOUTHERN:								
Keystone, Ala.	13.00	8.00	....	7.50‡	....	....	5.00e	13.75
Knoxville, Tenn.	13.00	8.00	8.00	7.50	5.00	....	5.00	13.50
WESTERN:								
Kirtland, N. Mex.	....	....	....	....	....	....	12.50f	....
Little Rock, Ark.	....	12.40	....	12.40	....	....	9.90	17.40
San Francisco, Cal.(b)	20.00	20.00	12.00	20.00	....	....	....	....
San Francisco, Calif.§	19.00	15.00	12.50	14.00	11.00	17.60†	11.00	17.60‖

(a) In 100-lb. bags. (b) Woodburnt lime: finishing hydrate, 20.00 per ton; pulv. lime, 2.00 per iron drum. Oil-burnt pulv. lime, 13.00–14.50 per ton. (c) In 50-lb. paper. (d) To 10.00. (e) To 6.50. (f) To 15.00. *At White Rock and Gibsonburg, Ohio. ¶In 200-lb. steel barrels. ‖Refund for return of barrels. †Refund for return of burlap bags. §To dealers and industrial concerns in carload lots. ‡To 9.00.

Potash Feldspar

East Liverpool, Ohio—White; analysis, K_2O, 10%; Na_2O, 3%; SiO_2, 68%; Fe_2O_3, 0.06%; Al_2O_3, 18%; pulverized, 98% thru 200 mesh, per ton, in bulk, 18.35; in bags 20.35

Erwin, Tenn.—White; analysis, K_2O, 10.50%; Na_2O, 2.75%; SiO_2, 68.50%; Fe_2O_3, 0.06%; Al_2O_3, 17.75%; pulverized, 98% thru 200 mesh, per ton, bulk, 14.00; in bags 15.20

Spruce Pine, N. C.—(Chemically controlled.) Color, white; 200 mesh; analysis, K_2O, 11.30%; Na_2O, 2%; SiO_2, 67%; Fe_2O_3, 0.10%; Al_2O_3, 18.60%; per ton, in bulk 15.00

Topsham, Me.—White; analysis, K_2O, 9.00%; Na_2O, 2.75%; SiO_2, 71%; Fe_2O_3, 0.06%; Al_2O_3, 16.50%; pulverized, 98% thru 200 mesh; per ton in bulk, 17.50; in bags 18.70

West Paris, Me.—(Chemically controlled.) Color, white; 200 mesh; analysis, K_2O, 11.20%; Na_2O, 3.20%; SiO_2, 65.70%; Fe_2O_3, 0.09%; Al_2O_3, 19.20%; per ton, in bulk 19.00

Soda Feldspar

Spruce Pine, N. C.—(Chemically controlled.) Color, white; 200 mesh; analysis, K_2O, 5.50%; Na_2O, 5.50%; SiO_2, 68.80%; Fe_2O_3, 0.10%; Al_2O_3, 18.60%; per ton, in bulk 18.00

Stone-Tile Hollow Brick

Prices are net per thousand, f.o.b. plant.

	No. 4	No. 6	No. 8
Albany, N. Y.*†	**40.00**	**60.00**	**70.00**
Altadena, Calif.	45.00	55.00	65.00
Asheville, N. C.	30.00	40.00	50.00
Atlanta, Ga.	**29.00**	**42.50**	**53.00**
Auburn, Wash.	....	50.00	65.00
Brownsville, Tex.		**53.00**	**62.50**
Brunswick, Me.	29.50	42.25	55.00
Chula Vista, Calif.	32.50	42.50	50.00
Daytona Beach, Fla.	45.00	55.00	65.00
Frostproof, Fla.	45.00	65.00	75.00
Houston, Tex.	36.00	53.00	66.00
Klamath Falls, Ore.	50.00	60.00	70.00
Longview, Wash.	....	50.00	60.00
Los Angeles, Calif.	**29.00**	**39.00**	**45.00**
Macon, Ga.	25.00	35.00	45.00
Mattituck, N. Y.	**45.00**	**55.00**	**65.00**
Medford, Ore.	**50.00**	**55.00**	**70.00**
Memphis, Tenn.	45.00	50.00	60.00
Mineola, N. Y.	40.00	50.00	60.00
Nashville, Tenn.*	32.00	50.00	60.00
New Orleans, La.	45.00	55.00	65.00
Norfolk, Va.	33.00	46.00	60.00
Passaic, N. J.	**40.00**	**52.50**	**70.00**
Pawtucket, R. I.	27.50	41.25	55.00
Presidio, Tex.	55.00	65.00	75.00
Roanoke, Va.	32.50	40.00	50.00
Salem, Mass.	**40.00**	**60.00**	**75.00**
San Antonio, Tex.	**37.00**	**46.00**	**60.00**
San Diego, Calif.	**35.00**	**44.00**	**52.50**
Spartanburg, S. C.	32.50	40.00	52.50

Prices are for standard sizes—No. 4, size 3½x4x12 in.; No. 6, size 3½x6x12 in.; No. 8, size 3½x8x12 in. *Delivered on job. †10% discount.

Whiting

St. Louis, Mo., per ton	15.00*
Chicago, Ill., prices per ton.	
Domestic putty whiting	10.00–12.00
Domestic precipitated whiting	15.00–20.00
Imported bolted whiting	30.00–35.00
Philadelphia, Penn. — English chalk whiting packed in 50-lb. paper bags, per ton, in carloads	15.00

*Packed in bbl., f.o.b. St. Louis.

Cement Building Tile

Lexington, Ky.:	
5x8x12, per 1000	**55.00**
4x5x12, per 1000	**35.00**
New Castle, Penn: Red, 9x15-in., per sq., 12.00; green, 9x15-in., per sq.	15.00
Wichita, Kan. (Duntile):	
8x8x12-in., each	.09
6x8x12-in., each	.08
6x6x12-in., each	.07½
4x5x12-in., each	.05
4x4x12-in., each	.04½

Cement Roofing Tile

Prices are net per square, carload lots, f.o.b. nearest shipping point, unless otherwise stated.

Cicero, Ill.—French and Spanish tile, 9x15-in., per sq.	9.50–12.00
Closed end shingle, 8¼x12½ in., per sq.	11.00–13.00
New York City, N. Y., per sq.	10.00

Cement Drain Tile

Grand Rapids and Saginaw, Mich.—Price per 1000 ft. in carload lots.

4-in.	42.00	15-in.	341.25
5-in.	52.50	18-in.	472.50
6-in.	78.75	20-in.	630.00
8-in.	115.50	22-in.	787.50
10-in.	173.25	24-in.	892.50
12-in.	199.50		

Concrete Block

Prices given are net per unit, f.o.b. plant or nearest shipping point.

Brookville, Penn.*: 8x8x16	18.00§–23.00a
8x10x16	25.00§–28.00a
Camden, N. J.: 8x8x16, each	.17b
Lexington, Ky.:	
8x8x16	**‡18.00***
8x8x16	**†16.00***
Omaha, Neb. (Prices f.o.b. yard)	
8x 8x16, each	0.09
8x12x16, each	.11½
8x 4x16, each	.06
8x 3x16, each	.06
8x 6x16, each	.08
Wichita, Kan.:	
4x8x16, each	0.08
8x8x16, each	0.09–0.10§
8x8x16, each	0.10–0.11a

***Price per 100 at plant.**
†Rock or panel face.
‡Face. §Plain. (a) Rock face. (b) Less 10%.

Concrete Brick

Prices given per 1000 brick, f.o.b. plant.

	Common	Face
Birmingham, Ala.	13.00	....
Milwaukee, Wis.	14.00	15.00–42.00
Prairie du Chien, Wis.	12.00	20.00–22.50
Rapid City, S. D.	16.00	30.00

Citizens Petition for Concrete Paving

PETITION that concrete instead of brick be used in improving East Main Street through Bexley, Ohio, was submitted recently to Mayor Ludwig and the Bexley council.

More than two-thirds of the abutting property owners who will be specially assessed for the improvement are signers of the petition.

The document calls attention to the resolution passed at the last Bexley council meeting, requesting the state highway department to award this for brick construction.

The petitioners request that Mayor Ludwig and the council rescind the resolution or take up personally with Governor White and Highway Director Merrell the question of the type of roadway for this strip.

"We feel that we are due this consideration on account of the great business depression and the lack of funds to take care of the unemployed situation.

"The saving of concrete over brick to the abutting property owners will materially assist them in having sufficient funds to pay their taxes at the end of the year," it was concluded in the petition.—*Columbus* (Ohio) *Dispatch.*

Seeks to Ban Gravel Pits

STEPS are to be taken by the new city administration to free Denver, Colo., from the menace of abandoned gravel pits.

These pits fill with seepage water from the Platte river, and several persons have been drowned in them. An investigation started by Mayor Begole disclosed the city has no ordinance whereby the situation can be handled. Damage suits have resulted against the city from fatal accidents in the abandoned pits.

At the regular cabinet meeting Tuesday, Walter B. Lowry, manager of improvements and parks, suggested the council pass an ordinance prohibiting gravel pits within the city limits. Mayor Begole said such an ordinance probably will be submitted to the council.—*Denver* (Colo.) *Post.*

Current Prices Cement Pipe

Prices are net per foot f.o.b. cities or nearest shipping point in carload lots unless otherwise noted

Culvert and Sewer	4-in.	6-in.	8-in.	10-in.	12-in.	15-in.	18-in.	20-in.	22-in.	24-in.	27-in.	30-in.	36-in.	42-in.	48-in.	54-in.	60-in.
Grand Rapids, Mich.																	
Sewer (c)	......	.09	.14	.21	.27	.36	.65	.78	1.04	1.17	1.45	2.16	......	......	......	......	......
Culvert (d)	......	......	......	.57	.67	.93	1.20	1.45e	......	1.80	2.10	2.45	3.30	4.00	5.10	6.00	7.45
Wahoo, Neb.	12-in., 15-in., 18-in., 24-in., and from 30-in. to 60-in. pipe, per ton, 10.00																

(a) Reinforced. (c) To dealers. (d) To contractors. (e) 21-in. pipe.

Gypsum Products—CARLOAD PRICES PER TON AND PER M SQUARE FEET, F.O.B. MILL

City or shipping point	Crushed Rock	Ground Gypsum	Agricultural Gypsum	Stucco Calcined Gypsum	Cement and Gaging Plaster	Wood Fiber	Gaging White	Plaster Sanded	Cement Keene's	Finish Trowel	—Plaster Board— ¼x32x 36". Per M Sq. Ft.	⅜x32x 36". Per M Sq. Ft.	Wallboard, ⅜x32 or 48" Lengths 6'-10'. Per M Sq. Ft.
Los Angeles, Calif.	....	16.00*	10.00*	16.00	17.00	....	14.00†	....	27.00‡	16.00	19.00a	21.00	....
Medicine Lodge, Kan.	1.45	....	....	....	....	....	11.50b	....	16.00b	....	....	....	....
Port Clinton, Ohio	4.00	6.00–8.00	6.00–8.00	10.00m	10.00n	10.00n	20.00k	8.00–11.00	24.50f	26.00g	15.00h	15.00h	27.00j
Oakfield, N. Y.	2.50	....	....	7.00b	9.00b	9.00b	....	6.00b	....	....	....	....	....
Winnipeg, Man.	5.00	5.00	7.00	13.00	14.00	14.00	....	....	....	....	20.00	25.00c	33.00d

NOTE—Returnable bags, 10c each; paper bags, 1.00 per ton extra (not returnable). (a) Plasterboard, ⅝x32x36 in. (b) Includes paper bags. (c) Includes jute sacks. (d) "Gyproc," ⅜x48-in. by 5 and 10 ft. long. (f) To 27.50. (g) To 29.00. (h) To 16.00. (j) To 28.00. (k) To 23.00. (m) To 12.00. (n) To 13.00. *To 20.00. †To 17.00. ‡To 38.00.

News of All the Industry

Incorporations

Western Lime Phosphate Co., Arlington, Wash., $3,000. Charles H. Grewe, L. H. Metzger and J. E. Wrage.

The Rose and Reid Stone Co. of Delaware, Wilmington, Del., $50,000. To deal in cement, lime, plaster and stone.

Blue Bell Fuel and Lime Co., Cleveland, Ohio, 100 shares no par stock. L. N. Wilfe, Alice E. Metzel and B. B. Goldman, 807 Williamson Bldg., Cleveland.

M-W Burial Vault and Construction Co., Inc., Evansville, Ind., 75 shares at $100 each. Bennett W. Whitehead, Arthur H. Mann and Jacob L. Weil. To manufacture concrete products.

Illinois Limestone and Fertilizer Co., Gladstone, Ill., $50.000 preferred stock and $50,000 common stock. W. R. Forquer, John A. Miller and W. A. Irons.

Doria Stone Co., Inc., Manahattan, New York City, 200 shares of no par value. Eugene Leone, Palisade Ave., Dobbs Ferry, N. Y.; Joseph Leone and Joseph C. Kenney, New York City. To produce stone and building materials.

Quarries

William J. King has purchased the stone-yard property of James E. Lynch, Poughkeepsie, N. Y.

Frank B. Holman has applied for a permit to operate a rock crusher in the Big Tujunga Wash, near Tujunga, Calif

Carbon Limestone Co., Youngstown, Ohio, bought the limestone interests of Hiram Parks and Sons in Hillsville, Penn., 50 years ago this August.

Hanford, Calif. The deal to lease a rock quarry in Tulare county hinges on whether the lessee should furnish the county, which owns the property, at 50c per ton or at 10% of the cost of production.

Tiffin, Ohio. Thieves raided the Clinton township quarry near here recently. Parts of the tractor which furnishes power for the cusher were taken.

Toccoa Rock Crushing Co., Cornelia, Ga., owned and operated by E. Schaefer for the past 30 years, closed when it was necessary to remove the tracks to its quarry in order to establish a new grade for the state road now being paved.

Alpena, Mich. It is reported that the M. Sullivan Dredging Co., of Detroit, will finish the dredging and dock work for the Thunder Bay Quarries Co. development here. All equipment of the W. J. Meagher Co., which started this work, has been moved from the operation.

Sand and Gravel

Western Wisconsin Gravel Co. has opened offices in Cochrane, Wis.

Sound Gravel Co., New York, is defendant in bankruptcy proceedings, it is reported.

Greenwood, Wis. Clark county has acquired title to a gravel pit near here. This gravel will be used to supply gravel on state and county roads.

General Storage Co., Cleveland, Ohio, acquired six yards from the Lake Ports Supply Co. recently, for storage of cement, stone, sand and gravel.

Columbia Sand Co., Columbia, S. C., has sold 3.5 acres of land to the Powell Paving Co. This is said to wind up the affairs of the sand company, which went out of business in December, 1928.

Martins Ferry Sand and Gravel Co., Wheeling, W. Va., has started operations to supply materials on its contract for the National Highway near St. Clairsville. It is reported operations will be on a 24-hr. basis.

A. H. Read Co. was caused to delay road construction on its road contract near Scottsbluff, Neb., until it changed screens at its plant to produce gravel meeting the state specifications.

Eastern Ohio Sand and Supply Co., East Liverpool, Ohio, has been granted permit to construct two bins on the Ohio river to be used in supplying materials on its contract for Ohio state route 7.

Munising, Mich. Experiments have been conducted on the sand in the deposit to be developed here by W. I. Sallee both by Mr. Sallee and by the Cleveland-Cliffs Iron Co., owners of the property.

Pilgrim Sand and Gravel Co., Farmington, N. Y., has taken title to the Willard Sand and Gravel Co. and is operating the plant. Philip J. Ross of Jamaica is president and William Pilgrim is vice-president.

Richmond Sand and Gravel Co., Richmond, Va., and its development in five years to an important position in the sand and gravel business was recently described in a local paper. An illustration of one of its plants was shown.

Ironton Gravel Co., Ironton, Ohio, has been sold by its receiver to the Union Sand and Gravel Co., Huntington. W. Va., for $6200. It is reported the operation will be abandoned and all equipment will be moved to Huntington.

Portsmouth Sand and Gravel Co., Portsmouth, Ohio, has obtained excellent publicity in the local paper through a news story based on requirements necessary for good concrete. It is pointed out that washed sand, such as it produces, is important in getting the best results with concrete work.

Oliver King Sand and Lime Co., Knoxville, Tenn., is the subject of complaint for smoke from the boilers of its plant on the river bank, which is reported as objectionable. Provision for jets, better firing or automatic stokers will cure this condition, T. J. Ashe, chief engineer of the smoke regulation bureau, said.

Crystal Springs Gravel Co. is being organized at Crystal Springs, Miss., by Montgomery and Birmingham, Ala., men. They have acquired 200 acres from the Southern Package Co., who operate a box factory near the city limits. Application has been made for spur tracks from the I. C. R. R. for hauling the gravel from mines. Operations will begin in about thirty days.

Cement

Oklahoma Portland Cement Co., Ada, Okla., has started a pipe line to connect its gas wells near Holdenville with those at the Boetcher field.

Southwestern Portland Cement Co., Osborn, Ind., recently loaded a 25-ton truck of cement at its plant there for delivery to a customer. The truck was properly equipped for loads of this size.

Banning, Calif. It is generally believed that a large cement plant will be built near Whitewater in case the proposed water aqueduct is built from the Colorado river to Los Angeles.

Medusa Portland Cement Co. employes at the York plant organized a permanent athletic association at a recent banquet of its mush ball teams. Officers were elected. A program followed the banquet.

Dewey Portland Cement Co., Kansas City, Mo., is defendant in a suit involving title to property occupied by its plant near Linwood, Ia. This is an appeal from the decision in favor of the Dewey company handed down April 15.

Monolith Portland Cement Co., Los Angeles, Calif., recently suffered damage to its Monolith plant by a flood. Its shipping facilities were not interrupted to any extent by the trouble, officials report.

Universal-Atlas Cement Corp. had its first accident in 16 months at the Hudson, N. Y., plant when James Popp, a veteran employe, fractured a bone in his ankle in sliding to the bottom of a hoppered car.

Medusa Portland Cement Co., Cleveland, Ohio, has issued the "Medusa Mirror" for August in which trophy dedication ceremonies at its plant are described. The entire issue is devoted to safety news.

Cement Products

Pacific Concrete Pipe and Gravel Co., Ltd., at Burquitlam, B. C., had its office robbed recently. Only cash in the safe was taken.

Cement Manufacturing Co., Holstein, Ia., had its plant damaged by fire recently. The loss was partly insured.

A. B. Keeport Coal and Cement Co., Indianapolis, Ind., recently lost its concrete block storage shed by fire.

W. M. McMichael, Tulsa, Okla., recently received some good publicity in the local paper. An illustration of his concrete truck mixing equipment was shown at his sand plant.

Ready-Mixed Concrete and Supply Co., Inc., of Nashville, Tenn., and the jobs on which it has furnished concrete were the subject of a recent news story in one of the local papers.

Stone-Tile and Supply Co., Knoxville, Tenn., has received local publicity in the newspapers describing its product, the method of manufacture and its use.

Akron Art Stone Co., Akron, Ohio, had an illustration and description of its burial crypts, or underground mausoleums, in a recent issue of the "Akron Beacon Journal."

Makins Sand and Gravel Co., Oklahoma City, Okla., is said to have furnished eight of the largest building jobs in the city in the last two years with ready-mixed concrete. A list of the jobs is given in a recent news item of the Oklahoman.

Arundel-Brooks Concrete Corp., Baltimore, Md., has let contract for a 4½-yd. mixer to Ransome Concrete Machinery Co. and for bins, batchers and other equipment to Stephens-Adamson Co. for its new ready-mixed concrete plant. Initial capacity is to be 1000 cu. yd. per day.

A. L. Houghtelin, Escondido, Calif., a cattleman, has been getting much publicity of late on a concrete tepee, which he has built and uses as his home there. It is on the summit of a high hill and is said to be 50 ft. high and 60 ft. in diameter at the base.

Detroit, Mich. E. F. Halpin has written the "Free Press" advocating the general use of concrete type safety zones that are big enough to provide real protection in Detroit. He cited the large number of accidents at safety zones which might be avoided by such installations.

Gypsum

Standard Gypsum Co. of Canada., Ltd., Vancouver, B. C., plans for the proposed new plant there were discussed recently by F. R. Ritchie, local manager, and Wallace C. Riddell, chief engineer, Standard Gypsum Co. of San Francisco.

Best Bros. Keene's Cement Co., Medicine Lodge, Kan., has mailed the August issue of the "Pioneer." Interesting information on mining operations and of work in which its product has been used are contained in the issue.

Lime

Hi-Way Lime Co., Pebble, Wash., is now operating its kilns. An air separator has been installed and it is ready to make delivery of its products.

Keith Lime and Specialties Co., Seattle, Wash., has moved its offices to 520 Denny Way. W. S. Keith heads the firm.

St. Joe Lime and Stone Co., St. Joe, Ark., is reported to be planning to rebuild part of its plant, recently destroyed by fire. It is an interest of the Eastern Arkansas Lumber Co.

Miscellaneous Rock Products

Colprovia Roads, Inc., announce the removal of its offices to room 657, 230 Park Ave., New York, N. Y.

Preston, Ida. A large deposit of calcite has been discovered and is being developed at Cleveland. It is being sold for chicken grit.

Hoover and Mason Phosphate Co., Chicago, Ill., elected the following officers at a recent meeting: Ray P. Hoover, president; Arthur J. Mason, vice-president; H. Earl Hoover, secretary.

Virginia-Carolina Chemical Co., Richmond, Va., has awarded the general contract for a $100,000 commercial fertilizer plant to be built at St. Louis, Mo. Completion is scheduled for December 1.

Birmingham, Ala. A slag plant is being built here by the Bowman Construction Co. on Thirtieth St. It will include a crusher and screening plant, with railroad siding for rail shipments.

Thermax Corp., Chicago, Ill., has issued a catalog describing its insulating and acoustical material. This catalog is a preprint of data to appear in the 1932 edition of Sweet's Architectural Catalog.

American Talc Co., Plymouth, Wis., now is producing and shipping from its operation near Milladore at the rate of one car per day. The plant is said to be in continuous operation throughout the year.

Marble Cliff Quarries Co., Columbus, Ohio, and its facilities for producing agricultural limestone, were recently described in an illustrated story in the "Columbus Citizen." The benefits to be derived through the use of agricultural lime as a soil conditioner and an animal food were told.

Canadian Industries, Ltd., is conducting an extensive program of replacement at the New Westminister plant of the Triangle Chemical division. An 8-page supplement to the "Toronto Post," August 8, was devoted to the activities of this company.

Ruhm Phosphate and Chemical Co., Chicago, Ill., recently elected the following officers at its meeting of stockholders: John Ruhm, Jr., Mt. Pleasant, Tenn., president and treasurer; Ray P. Hoover and H. G. Ruhm, vice-presidents; H. Earl Hoover, secretary; Miss S. L. Jones, assistant secretary; J. J. Thompson, sales manager. The business of the company is said to be confined to lime phosphate for feeds and application to the soil.

Consolidated Mining and Smelting Co., and its new plant at Trail, B. C., has been described in detail in an interesting story recently appearing in the "Spokane (Wash.) Chronicle." It is said 450 tons of phosphate rock are used daily in its operation. In addition to fertilizers and chemicals, gold and other precious metals are refined at this plant. "With the cost of supplies and salaries the hourly operating expense of the plant is $2000," one official has said.

Personals

Reuben H. Brown has been appointed manager of the New Orleans branch of the Bemis Brothers Bag Co.

Forrest U. Webster, advertising manager for Cutler-Hammer Co., was seriously injured in an aeroplane crash at Pittsburgh, Penn., recently. It is reported that he will recover.

J. E. Jellick recently spoke before the Richmond, Calif., Kiwanis Club on the manufacture of portland cement. His subject was "Putting a Mountain Through a Sieve."

J. C. Hutchinson, Chewelah, Wash., has been appointed general manager of the Northwest Magnesite Co. plant of that place. **C. L. Cole** has been made superintendent.

Firman E. Bear, director of research, American Cyanamid Co., recently returned from a visit to Europe where he made a study of the fertilizer situation in England, Holland, Belgium, Poland, Czechoslovakia, Germany, Italy and France.

D. L. Ghiotto, foreman for Florida Rock Products Co., suffered an injury to his eye recently which may result in loss of sight. In supervising the cutting of a piece of iron a small piece of metal struck him in the eye.

Arnold Watson, an employe of the Union Sand and Gravel Co., Huntington, W. Va., had both feet badly mashed recently. He was sitting on the side of a barge as it entered an Ohio river lock and his feet were caught between the barge and the lock wall.

Carl R. Rolf, representative of the Pioneer Gravel Equipment Manufacturing Co. of Minneapolis, Minn., has been in Seattle and vicinity for several days on a business visit. Mr. Rolf spent some time there with Frank J. McHugh, president of the Olympic Equipment Co., Inc., distributors for the Pioneer company's equipment in that district.

John S. Bleecker has been appointed manager of sales of Lukenweld, Inc., Coatesville, Penn. He graduated from the Massachusetts Institute of Technology in 1898 where he specialized in both mechanical and electrical engineering. For 27 years he was associated with Stone and Webster and engaged on other important engineering projects. From 1928 and until his association with Lukenweld, Inc., in 1931, he was a registered professional engineer engaged in industrial and public utility work.

H. J. Beach

H. J. Beach has been elected president of the Flexible Steel Lacing Co., Chicago, Ill., to succeed P. S. Rinaldo, who passed away in May; other officers elected were: M. B. Beach, vice-president; H. L. Coats, secretary; P. S. Rinaldo, Jr., treasurer, and J. C. Olsen, assistant secretary. Mr. H. J. Beach has been active in the company for 19 years, having occupied executive responsibilities in practically every phase of the business. He, M. B. Beach and P. S. Rinaldo, Jr., are sons of founders of the company.

R. R. Davis, who has directed, in the past 21 years, various Westinghouse advertising activities, has been appointed apparatus advertising manager of the Westinghouse Electric and Manufacturing Co., at East Pittsburgh, Penn. He will have charge of all apparatus advertising activities of the company except the merchandising department, headquarters for which are located at Mansfield, Ohio. Mr. Davis has been active in the creative as well as the executive side of every form of advertising, and its associated media and methods, that has been used by the Westinghouse company.

E. W. Loomis has been appointed as Middle Atlantic district manager of the Westinghouse Electric and Manufacturing Co., with headquarters in Philadelphia, Penn. Mr. Loomis is a graduate of the University of Delaware, which institution recently honored him with the honorary degree of Electrical Engineer. After graduation in 1914, he entered the student course of the Westinghouse company at East Pittsburgh with whom he has been associated since. Immediately prior to his present appointment he was manager of the Northeastern Industrial Division.

Obituaries

Donald Cashman, 27, son of Mr. and Mrs. John Cashman, was killed when he fell from a 30-ft. scaffold at a stone quarry operated by his father near Danville, Highland county, Ohio.

Charles M. Carver, 46, died at Middletown, Ohio, recently. He was superintendent of construction for the Middletown Sand and Gravel Co. He formerly lived in Dayton.

Leonard R. Nelson, 34, former department manager in Denver, Colo., for the Monolith Portland Cement Co., committed suicide in Los Angeles, Calif., August 11. No apparent reason is known. He was a bachelor.

Thomas Newell, yard superintendent for Material Service Corp., Chicago, Ill., was killed August 18 when he tried to rescue James Dooley from a sand hopper on the company's property. When Mr. Dooley lost his balance and fell into the sand Mr. Newell leaped in to save him and was himself engulfed. Mr. Dooley was rescued by other workmen.

Henry W. Zimmermann, president, Atlas Engineering Co., Milwaukee and Clintonville, Wis., manufacturer of conveyors, concrete mixers, car unloaders and other equipment, died August 9, aged 72 years. He was born in Milwaukee. He founded the Atlas company in 1915.

Wm. F. Schneck, 63, one of the founders of Schneck and Lansford, Louisville, Ky., concrete products manufacturers, died August 16 at his home after an illness of six months. He was a native of Floyd county, Ind., and came to Louisville in 1892.

Manufacturers

Allis-Chalmers Manufacturing Co., Milwaukee, Wis., on August 10 announced new orders totaling $1,006,000 as a result of the recent acquisition of the American Brown Boveri Co., Inc., and the Condit Electrical Manufacturing Co.

Babcock and Wilcox Co., New York, N. Y., announces that Fred Sprinkman and Sons, Milwaukee, Wis., have been appointed distributors of B. & W. No. 80 refractory mortars and plastics for that district.

Worthington Pump and Machinery Corp., Harrison, N. J., announces it has acquired the manufacturing and marketing facilities of Metalweld, Inc., Philadelphia, Penn. Worthington's feather valve compressors have always been an integral part of Metalweld portable units and with this new arrangement Worthington will now manufacture the complete unit at the Harrison, N. J., works.

Elliott Service Co., Inc., of New York City, announces the following executive personnel changes: R. T. Solensten, former manager of the industrial division, to become vice-president; J. O. Emerson, editor of the National Board of Foremanship, to become manager of the industrial division. Mr. Solensten in his new position will assume direction of more extensive research in industrial educational methods that has been planned by the Elliott organization. Mr. Emerson will have direct charge of production and distribution of the Elliott industrial services, bulletin board displays, suggestion systems, and other management helps.

Trade Literature

NOTICE—Any publication mentioned under this heading will be sent free unless otherwise noted, to readers, on request to the firm issuing the publication. When writing for any of the items kindly mention Rock Products.

Nickel Cast Iron. "Nickel Cast Iron News" illustrates and explains many applications of this material in a wide variety of applications. INTERNATIONAL NICKEL CO., New York, N. Y.

Speed Reducers. Bulletin 53 gives detailed information on the new Herringbone-Maag speed reducer for small electric motor drives, recently developed. Engineering data is included. W. A. JONES FOUNDRY AND MACHINE CO., Chicago, Ill.

RETAIL MATERIAL PRICES, DELIVERED, JULY 1. (COMPILED BY DEPARTMENT OF COMMERCE)

City	Portland cement, per bbl. exclu. of cont.	Gypsum wallboard, ⅜-in., per M	Hydrated lime, per ton	Building sand, per cu. yd.	Crushed stone, ¾-in., per ton	Gypsum plaster, neat, per ton
New Haven, Conn.	$2.70	......	$19.00	$1.25	$2.25	......
New London, Conn.	2.60	......	18.00	1.50	3.00	$18.00
Waterbury, Conn.	2.60	30.00	20.00	1.25	2.45	20.00
Haverhill, Mass.	2.60	25.00	18.00	......	......	18.50
New Bedford, Mass.	2.80	24.00	16.50	1.75	2.75	16.50
Albany, N. Y.	2.52	24.75	15.75	......	......	17.10
Buffalo, N. Y.	2.95	21.00	18.00	1.85	2.05	16.00
Poughkeepsie, N. Y.	2.50	......	20.00	2.25	2.20	......
Rochester, N. Y.	2.28	22.00	20.00	......	2.40	16.00
Syracuse, N. Y.	2.16	25.00	13.00	1.80	1.70	15.00
Paterson, N. J.	2.20	24.00	18.00	1.50	2.10	17.50
Trenton, N. J.	1.64	24.00	18.50	1.65	2.15	17.50
Philadelphia, Penn.	2.16	......	14.50	1.75	2.60	17.50
Scranton, Penn.	2.60	......	20.00	3.25	......	19.00
Baltimore, Md.	2.20	......	13.00	2.00	2.50	15.50
Washington, D. C.	1.88	25.00	13.00	......	......	16.00
Richmond, Va.	3.10	31.00	17.50	1.95	2.45	20.00
Fairmont, W. Va.	2.80	35.00	16.00	3.00	3.50	18.00
Columbia, S. C.	2.40	35.00	12.50	1.50	2.75	15.50
Atlanta, Ga.	2.20	......	12.50	2.50	2.50	15.00
Tampa, Fla.	2.60	......	20.00	2.00	4.00	20.00
Birmingham, Ala.	2.80	......	20.00	3.00	2.50	17.00
Shreveport, La.	3.20	......	......	2.00	3.80	22.00
New Orleans, La.	2.20	......	14.00	1.80	......	18.00
Erie, Penn.	2.20	22.50	16.00	2.00	......	16.00
Akron, Ohio.	1.74	......	12.00	1.50	2.50	14.00

City	Portland cement, per bbl. exclu. of cont.	Gypsum wallboard, ⅜-in., per M	Hydrated lime, per ton	Building sand, per cu. yd.	Crushed stone, ¾-in., per ton	Gypsum plaster, neat, per ton
Canton, Ohio	......	......	$16.00	$2.50	......	......
Cincinnati, Ohio	$2.14	$22.75	14.00	2.63	$2.55	......
Cleveland, Ohio	1.68	......	10.00	1.69	2.15	$15.00
Columbus, Ohio	2.35	......	12.00	1.50	2.75	14.40
Toledo, Ohio	......	22.00	16.00	2.00	2.25	15.70
Detroit, Mich.	2.60	25.00	14.80	2.03	1.95	......
Lansing, Mich.	2.25	......	......	2.10	......	16.00
Saginaw, Mich.	1.61	24.00	16.50	2.50	2.18	18.00
Terre Haute, Ind.	2.25	28.00	18.00	1.25	3.00	18.00
Louisville, Ky.	1.86	......	15.50	2.00	2.15	17.00
Rockford, Ill.	2.60	25.00	20.00	1.40	1.15	16.00
Milwaukee, Wis.	1.48	22.00	14.00	1.35	1.35	15.20
Des Moines, Iowa	2.00	25.00	15.00	1.65	3.50	15.00
Kansas City, Mo.	1.80	25.00	......	1.70	1.88	15.00
St. Louis, Mo.	1.85	......	18.00	1.35	1.00	18.00
St. Paul, Minn.	2.15	24.00	17.00	1.40	2.08	17.00
Grand Forks, N. D.	2.80	30.00	26.00	2.60	......	20.00
Sioux Falls, S. D.	2.40	......	24.00	1.25	2.25	15.50
Wichita, Kan.	1.60	......	22.50	1.00	1.25	15.00
Tulsa, Okla.	1.90	22.50	22.00	.85	2.60	16.00
San Antonio, Tex.	2.43	40.00	20.00	2.25	1.88	19.15
Tucson, Ariz.	3.37	40.00	30.00	1.25	2.25	17.10
Los Angeles, Calif.	2.30	23.50	24.70	1.85	1.90	15.20
San Francisco, Calif.	2.40	......	22.50	1.40	1.60	16.90
Portland, Ore.	1.75	......	22.00	1.30	1.90	20.00
Seattle, Wash.	2.50	35.00	22.00	1.60	1.90	20.00

Recognized the World Over as the Leader in Its Field

Rock Products

With which is Incorporated CEMENT and ENGINEERING NEWS Founded 1896

Entered as second-class matter, July 2, 1907, at the Chicago, Ill., postoffice under the Act of March 3, 1879.

Contents for September 12, 1931

Departments

(Rock Products is indexed in the "Industrial Arts Index," which can be found in any Public Library)

TRADEPRESS PUBLISHING CORPORATION

542 South Dearborn Street, Chicago, Illinois, U. S. A.

W. D. Callender, President; N. C. Rockwood, Vice-President; C. O. Nelson, Secretary

LONDON OFFICE: Dorland House, Mezzanine Floor, 14 Regent St., S.W. 1.

NATHAN C. ROCKWOOD, *Editor and Manager*
EDMUND SHAW, Los Angeles, Calif., *Contributing Editor*
EARL C. HARSH, WALTER B. LENHART, H. O. HAYES, *Associate Editors*
A. M. STERN, *Assistant Editor*
FRED S. PETERS, *Advertising Manager*
E. A. SINE, *Production Manager*

RALPH C. SULLIVAN, E. H. PAULL, *Eastern Representatives*
280 Madison Ave., New York City. Tel. Caledonia 5-4474

GEORGE M. EARNSHAW, *Central Advertising Manager*
2380 Winfield Ave., Rocky River, Ohio. Tel. Boulevard 4353

NORMAN BOGGS, C. L. WALKER, *Western Representatives*
Chicago. Tel. Wabash 3714-3715

SUBSCRIPTION—Two dollars a year to United States and Possessions. Three dollars a year to Canada and foreign countries. Twenty-five cents for single copies

TO SUBSCRIBERS—Date on wrapper indicates issue with which your subscription expires. In writing, to have address changed, give old as well as new address

The A. B. P. is a nonprofit organization whose members have pledged themselves to a working code of a practice in which the interests of the men of American industry, trade and professions are placed first—a code demanding unbiased editorial pages, classified and verified paid subscribers, and honest advertising of dependable products. The A.B.C. is an organization which audits and verifies publishers' circulation claims and records.